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Science and Art Gossip.

Southampton, *Aug.* 22, 1882.

IF we may judge from some of our daily and weekly contemporaries, the proper thing at this juncture would be to occupy five or six columns of KNOWLEDGE with matter more or less carefully compiled from a Southampton guide-book. As, however, we do not see in what way this would be useful to those of our readers who are not visiting Southampton, while those who are will probably provide themselves with one or other of the various guide-books sold here, we will not inflict on our readers dissertations on Cerdic the Saxon, the Danish irruptions into Hampshire, Bevis of Hamptoune, and other subjects not strictly pertinent to science or art, or even to the British Association, except as affording matter for gossip during the excursions with which the committees propose to lighten the work of science. As to the Association itself, it is known to our readers that Dr. Siemens will preside, as successor to Sir John Lubbock, that Professors Thomson, Moseley, and others will deliver lectures, and that there will be the customary sectional gatherings. Whatever of interest may transpire on these occasions we shall describe, without technicalities, and as clearly and succinctly as possible, to the readers of KNOWLEDGE, noting that, as on former occasions, the bulk of the yearly volumes issued by the Association has not always afforded an exact measure of the matters of real novelty and interest brought before the members and associates, so it may be that we shall not find it necessary to describe, even in abstract, every single communication which may on this occasion be brought under the notice of the Association. In thus endeavouring to separate the wheat from such chaff as may possibly come under the action of our winnowing fan, we believe we shall be rendering as useful a service to our readers as in substituting, as far as possible, the words of ordinary discourse for the technicalities of scientific verbiage.

SEVERAL correspondents ask that there should be more astronomy, and especially that the papers should be resumed and extended in which monthly notice was given of celestial phenomena. When these were in progress, several complained that there was too much astronomy, and the editor (himself naturally preferring to have as much astronomy as readers would stand) yielded to their wishes. He proposes, however, after British Association matters have been disposed of, to resume and extend (but with care to attain compactness) the astronomical notes, which seem to have proved of real use to amateurs. Among the plans which he intends to carry out, is the monthly issue of a map of some constellation favourably placed for observation, with the places shown of all double stars of interest in Mr. Webb's "Celestial Objects for Common Telescopes," accompanied by drawings of ten or twelve of those objects. He trusts thus to form a collection which will prove of interest and value to amateur telescopists. A series of views of the northern heavens as seen from southern latitudes, which will be in reality views (for the same hours) of the southern heavens as seen from northern latitudes (a problem which we present for the amusement and study of the flat-earth men) will also appear monthly in KNOWLEDGE. Our geological contributor has not hitherto been able to fulfil his promises, but we trust he will shortly do so.

A MAN OF GREAT BRAIN.—The heaviest brain ever weighed in the United States was taken from the skull of James H. Madden, who died in Leadville on July 6. The doctor who attended him during his last sickness had observed the immense frontal and lateral development of his head, and determined to weigh the brain, but his astonishment was great when it brought down the scales at sixty-two and a quarter ounces. Cuvier's brain weighed sixty-four and a half ounces—considerably surpassing all other records—but the brains of Napoleon, Agassiz, and Webster, though phenomenally heavy, were much lighter than Madden's. It is an interesting circumstance that Madden was not a naturalist, a soldier, or a statesman, but a gambler.

MEASUREMENTS of the winter movement of a large glacier in North Greenland (the Fjord of Jacobshavn), have been recently made by Herr Hammer, and the summer observations of Herr Helland on the same glacier in 1875 can be compared with them. The velocity is much the same, apparently, in summer and in winter; about fifty feet in twenty-four hours may be taken to represent the rate in the middle of the glacier, where it is greatest.

UPHEAVING OF LAND.—The Finnish newspapers record a striking instance of the extent to which the land on the shores of the Gulf of Bothnia is being gradually upheaved. It appears that on June 25, 1755, a land-surveyor named Erik Klingius, residing in the parish of Bergö, between the town of Nikolaistadt and Kaskö, made an excavation in the smooth rock at an elevation of two inches above the level of the sea. On being lately measured, the present height was found, after the lapse of 127 years, to be six feet five inches above the sea-level.

WATER FROM WOOD.—By thrusting the ends of green scrub wood—"mallec scrub"—in the fire, and catching the sap driven out at the other end in a bark trough, an Australian supplied himself with water and saved his life while crossing in a waterless region. He says that a dozen mallec sticks, 4 ft. long and 2 in. or 3 in. in diameter, would give a pint of water in an hour, and suggests that the same device may possibly be found of vital importance to other bush-rangers and travellers in arid regions.

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THE NATIONAL GALLERY.—The Bill which Earl Granville has introduced with regard to the National Gallery proposes to empower any two or more of the Trustees, together with the Director, present at any meeting specially assembled for the purpose, to order that any pictures or other works of art under their control, which can, in their opinion, be spared from the national collection, be lent to any public gallery. Such a loan would be made for such time, and subject to such conditions, as the meeting might determine. A condition of a loan would be that all profits derived from any exhibition at the gallery to which the loan is made shall be devoted altogether to the promotion of science and art. Pictures which have been acquired under any gift or bequest would not be lent until the expiration of fifteen years from the Gallery's possessing them. And this period is extended to twenty-five years where there is a condition of the gift that the pictures given shall be kept together, or one that is inconsistent with their being lent. The expression "public gallery" includes those in the United Kingdom which are under the control of the Government, or of any municipal authority, or of any society or body approved by any two or more of the Trustees of the National Gallery and the Director.

MALARIA IN NEW ENGLAND.—A short time ago the key to the mysterious extension of malarial diseases in New England was supposed to have been found in the damming of the streams for manufacturing purposes. Now the Boston *Advertiser* says that intelligent people living in the districts invaded say that the appearance of malaria in New England dates from the introduction of the cultivation of tobacco on a large scale upon the intervales of the Connecticut, and that its spread has kept even pace with the extended growing of this crop. The most plausible theory of the introduction and propagation of the aerial poison is this: To keep up the productiveness of the soil, fertilisers are freely used. The manure is brought from New York city, mostly in scows, which are unloaded on the banks of the river where the cargo is to be used. All the autumn and winter these heaps of putrid matter are fermenting and breeding disease. The air that comes in contact with these piles of filth is contaminated, and rendered as unfit for human lungs to inhale, as it is offensive to the senses.

A VENOMOUS LIZARD.—Stories about venomous lizards of different species are abundant in India and other tropical countries, but on investigation have always been found to be destitute of foundation. There is, however, one lizard of which the bite is certainly highly dangerous, though probably not fatal, to man. This is the Heloderm (*heloderma horrida*) of Mexico and Lower California, commonly known to the natives of those countries as the "scorpione" or "scorpion." An example of this lizard has lately been presented to the Zoological Society's collection by Sir John Lubbock, and may now be seen in the reptile-house. The deadly effect of the bite of this lizard upon small mammals has been proved by actual experiment, and Mr. J. Stein, a traveller in Mexico, who was bitten in the finger by one, suffered from symptoms similar to those produced by a snake bite. The specimen in the Zoological Society's collection is about 15 in. long, and was forwarded to Sir John Lubbock by Mr. Treadwell, of the Central Arizona Mining Company. It is believed to be the first that has reached Europe alive. An article by Dr. Andrew Wilson on this interesting animal will appear in an early number.

THE National Legislature of the United States pursues its intelligent and intellectual course with respect to foreign literature. "Perhaps," says the *American Naturalist*, "the secretary of the treasury desires to aid the friends of repeal by a *reductio ad absurdum* of some of the provisions of our tariff law. By a ruling of this department made some time last month, all books coming through the foreign mail for private persons are charged a duty of 25 p.c. if of the value of 1 dol. and over. To collect this amount the book must be sent from the Post-office to the Custom-house, then from the Custom-house to the appraiser's store, where a valuation is put on it. It is then returned to the Custom-house, from which a notice is issued to the addressee. All this requires the filling of blanks and the obtaining of the signatures of eleven or twelve officials, by which the government is richer frequently by 25 or 50 cents. A more disreputable law it would be difficult to imagine. Only the poor student is taxed in his efforts to elevate himself above the general dead level. The aspirations of the seeker for knowledge have, it seems, to be paid for, although by following them the student usually resigns the opportunity of financial success in life. We know very well that it is not the producers of books in this country that desire protection. The sale of their wares abroad depends on their merits, and the production is not to be stimulated by a protective duty. It is the publisher who, like another noted character, sits

"Hard by the tree of knowledge,"

to whom we are indebted for this beautiful piece of legislation. We are not opposed to a protective tariff under certain circumstances; but we are opposed to one on the intellectual development of our people. It is worse than blood-money, it is soul-money. It is a discrimination against the cultivators of thought and mind, and intelligent members of our National Legislature must surely, ere long, see it in this light."

CLOUD IN THE AIR.

BY THE EDITOR.

(*Continued from page* 179.)

ONE of the most interesting consequences of the real form of the cloud layers above the horizon of a place is the greater cloudiness of the sky near the horizon, even when clouds are no denser in the air above those spots which lie towards the horizon than they are overhead. I have often been amused to hear the passengers on an ocean steamship speak of the cloudy region towards which the ship is travelling, as if they would presently lose the pleasant sunlight, when, in reality, a glance back along the ship's course, or on either side, showing just the same cloud-wrapt sky all round, should have shown that the clear sky overhead was an effect of the observer's position, not due to any real difference in the state of the air overhead.

It may be well first to notice that even when there are no clouds at all, and when the air overhead seems perfectly clear, the sky near the horizon may seem involved in thick mist, though the air *there* be in reality as clear as the air overhead. The deception is akin to that which Sir Edmund Beckett has noticed in that most interesting work of his, "A Book on Building"—*akin*, though not precisely the same. A "curious and common delusion," he says, "on the part of the dwellers in houses in low and obviously damp situation is, that by some peculiar idiosyncracy of the air, or providential interference, the fog never reaches them, but always stops at some convenient boundary which they point out to you. But if

they will go and stand beyond that boundary, in a fog, they will discover the equally curious fact that their house is then just within the fog; the explanation of which is, that you can see a certain distance through an ordinary damp fog much as if there were none, but no further." Just so if you are near a particular part of the shore on what seems a perfectly clear day, you shall see the shore to a certain distance—perhaps ten or twelve miles or more—beyond which it is lost in haze; but when you have reached the spot which had seemed thus enwrapped in mist, you find the part where before the air had before seemed clear to be equally enshrouded; the reason being, as in the other case, that you can see through a great quantity of air laden with light haze, yet beyond a certain distance you cannot see; and by a delusion, common to all cases of vision through clouds, the haze, which is really very thin, and really lies along the whole space between the eye and a distant object or landscape, seems to be thick, close to, and around the object or landscape which it hides or nearly hides from view. Aiding this illusion, of course, if not playing the chief part in causing it, is the delusion we are now considering, as to the true shape of the atmospheric region above our natural horizon.

Let us, for instance, consider the question of the general haziness towards the horizon. Consider a layer of air one foot thick, throughout which a very thin haze is spread, so that to an eye looking squarely through the layer no perceptible effect of obstruction is perceived. Overhead, then, the sky is perfectly clear, so far as this particular layer is concerned. Let us consider what its obstructive effect will be close by the horizon, assuming that it lies at a height of (roughly) an eighth of a mile above the observer, who is supposed to have a sea horizon. Note that the lower it is, the greater will be the effect, or rather the difference of, effect we are considering:—Let C, Fig. 1, be the place of the observer, ADB the upper surface of the layer of

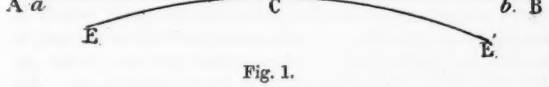

Fig. 1.

air we are dealing with, *adb* its under surface, and *db* one foot. What we have to determine is the breadth A*a* or *b*B through which the line of sight towards the horizon passes. Proceeding as we did in last paper, we find (putting the diameter of the earth as 8,000 miles)

$(Ac)^2 = DC.\ 8{,}000 = 1{,}000$; and $(aC)^2 = dC.\ 8{,}000$

$\therefore (AC)^2 - (aC)^2 = AC - aC)(AC + Ac) = Aa.aB = Dd.8{,}000$

Thus we have the proportion—

$$Aa : Dd :: 8000 : Ac$$
$$:: 8000 : \sqrt{1000}$$
$$:: 8000 : 32 :: 22.5 : 1 \text{ roughly.}$$

So that the line of sight passes through 22·5 feet of haze-laden air, or roughly $7\frac{1}{2}$ yards, in direction CA and CB instead of the one foot of such air through which it is directed in looking towards D.

But now note that in the case of such very thin haze as occupies the air on an ordinarily clear (or even a very clear) cloudless day, the most effective part of the haze lies much nearer the ground than the eighth of a mile; and that the nearer the ground is any layer we deal with as above, the greater is the disproportion between A*a*, B*b*, and D*d*. Suppose, for instance, we had considered a layer also one foot thick, passing at a height of only 40 yards, or one 44th part of a mile overhead. Then we should have found $(AC)^2 = 8000 \div 44 = 182$; whence we shall have AC equal to between thirteen and fourteen miles. (Note, by-the-way, the striking circumstance that a layer of air 40 yards high reaches the horizon plane no nearer than some 13 or 14 miles away). This would give A*a* a greater than D*d* as 8000 is greater than about $13\frac{1}{2}$, or about 59 times. So that for this layer the line of sight passes through nearly 20 yards, instead of one foot, as it does overhead. For lower layers yet, and we must remember that the layers come right down even to the observer's place, the disproportion is greater yet. It follows necessarily that however lightly the air may be laden with haze, the observer looks through a great quantity of such haze, when it is directed towards the horizon. Only when the air is very pure indeed, then, are the heavenly bodies near the horizon seen under conditions approaching those under which they are seen when high overhead.

But the effects are still more curious when we consider cloud layers, for here we have often effects of foreshortening to consider, which alter a sky overhead, over which clouds are scattered with wide spaces between, into a sky entirely cloud covered, when we look towards or near the horizon.

Into these effects, and others akin to them, we must next inquire.

(To be continued.)

A GLASS OF WINE.

No. I.

By Dr. F. R. Eaton Lowe, M.A.

A GLASS of wine is not unfrequently regarded as a kind of passport to new friendships, and a tenacious cement to old ones. A parting "glass" is supposed to be the true expression of our regret on taking leave of a friend; while another glass is the inevitable exponent of our joy upon his return.

Something akin to this highly refined and pleasing custom obtains amongst uncivilised races. The simple African entertains his friends with his choicest palm wine, which has been stored up for festive occasions in calabashes; while the Tartar, actuated no doubt by the best intentions, well plies his company with the oldest arrack.

The virtues of a glass of wine have been so highly extolled in some quarters, that one would suppose it to be a panacea for half the ills that flesh is heir to; while, on the other hand, some writers, no doubt with equal sincerity, have ascribed to its daily use some of the most terrible evils that can afflict humanity.

The object of the present paper is not to attempt the settlement of contested points, or to enter upon the debatable ground opened up by the question in its physiological aspect; but simply to see what liquids and solids we have got in our glass of wine. When the physiological action of the separate constituents is understood, it will not be difficult to arrive at an approximate notion of the aggregate effect upon the human constitution. The most interesting ingredient in wine is, of course, the *alcohol*, or the intoxicating principle. Alcohol is one of the products of the fermentation of sugar; and this process of fermentation is one which has given rise to much difference of opinion amongst physicists, as it involves a phenomenon altogether out of the range of chemical decomposition. Fermentation has been known from the earliest ages; but it was not till yeast was examined by Fabroni, an Italian chemist who

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lived towards the end of the last century, that some light began to dawn upon the subject. About 200 years ago, the famous Dutch microscopist, Leeuwenhoek, discovered that yeast consisted of a collection of minute cells or grains, as he called them, floating about in a thin liquid. No further investigations appear to have been made into the nature of this substance for another hundred years, when M. Appert, at the beginning of the present century, turned his attention to the subject of decay, and its prevention. He found that meat and other organic matter might be preserved from putrefaction for almost any length of time by cutting off all access of air. Yeast was one of the substances which came under his examination, and he found that air was essential to its formation, and that, if the wort of beer or the must of wine is boiled and kept in a closely-stoppered bottle, no fermentation will ever be set up. This was a very important discovery, because it revealed to us the existence of minute germs or sporules in the atmosphere, which have the power of setting up those chemical changes in sugar which accompany the process of fermentation. Further experiments showed that if we filter the air in its passage into a bottle of fermentable matter by a plug of cotton wool, so as to prevent the entrance of the sporules, no fermentation will ensue, notwithstanding the fact that the air has free access through the plug. If the vitality of the sporules be destroyed by passing the air through a red-hot platinum tube, all power of originating fermentation will, in like manner, be lost. It had before been noticed by Cagniard de la Tour that Leeuwenhoek's little grains grew from one another — that, when a cell became fully developed, it gave off from its side a minute bud or embryo cell, which, in its turn, enlarged, and ultimately sent forth another bud. This propagation by gemmation or budding is exactly analogous to the mode of growth in cellular plants, as mildew and other fungi. Yeast is, therefore, neither more nor less than a plant of a low order, and has received the name of *torula* (Mycoderma cerevisiæ). Fabroni soon afterwards examined these yeast-cells chemically, and found that they consisted of a kind of bag, composed of cellulose, or woody fibre, containing a liquid whose composition was proteinaceous or nitrogenous. As the cells which compose the flesh of animals contain an albuminous liquid of similar composition, Fabroni called yeast a vegeto-animal. So far the yeast-plant had come within the range of experimental demonstration; but when chemists began to theorise upon fermentation and the *modus operandum*, they entered the arena of speculative uncertainty, within which they are still groping. That yeast is the agent which causes the decomposition of sugar into alcohol and carbonic acid is indisputable, and that it appropriates some of this sugar for the purposes of its own nutrition is equally certain, but in what way its power is exerted is a question upon which eminent chemists are still at issue. M. Thenard and M. Pasteur believe that the torula attacks the sugar, and by assimilating a portion for its own growth, causes the decomposition of the remainder. Liebig, however, denies this, and ascribes the decomposition to the action of the vital forces having their origin within the plant itself. The doctrine of spontaneous generation, which some have held in reference to the yeast-germs, is altogether inadmissible in the face of modern evidence. The protoplasm, or liquid matter of the yeast-sacs, contains ammoniacal salts and alkaline phosphates, so that the plant lives not only at the expense of the sugar, but of the gluten which is associated with it in the must of wine and the wort of beer. The cells are exceedingly minute, the largest being only the two-thousandth of an inch in diameter, while the smallest are not more than the seven-thousandth of an inch in diameter.

Now let us see what takes place when sugar undergoes fermentation. When glucose or grape sugar is exposed to the air at a temperature of 25° C, or 30° C, the sporules of the torula find in it the conditions of their existence, and chemical changes are at once set up. There is an appearance of frothing from the escape of gas through the syrupy mass; and when the action is complete, all sweetness will have vanished, and a spirituous taste become apparent. In fact, alcohol has been produced, and carbonic acid gas given off.

The formula for glucose is $C_6H_{12}O_6$ which in plain language means, that it is composed of 6 equivalents of carbon, 12 of hydrogen, and 6 of oxygen. This may be shown to be equal to alcohol plus carbonic acid by the following equation :—

$$C_6H_{12}O_6 = 2\,(C_2H_6O) + 2\,(CO_2)$$

The formula for alcohol being C_2H_6O, and that of carbonic acid being CO_2 the equation represents that from one equivalent of grape sugar we obtain 2 equivalents of alcohol and 2 of carbonic acid. Lavoiseur was the first to examine quantitatively the products of the decomposition, and came to the conclusion that the weight of the carbonic acid and alcohol together was exactly equal to the weight of the sugar employed. For many years this was accepted as true; but subsequent experiments proved that this was only true of about 94 per cent. of the sugar, and that the remaining 6 per cent. was split up into other compounds, as glycerine 3·5 per cent., succinic acid 0·6 per cent., cellulose and fatty matter, forming the sac or bladder of the yeast-cells, 1·7 per cent. Fermentation is, therefore, a much more complicated affair than was at one time supposed; in fact, a fractional part of the percentage is not yet satisfactorily accounted for.

There are other kinds of fermentation besides the alcoholic; thus, we have the acetous and the mucous fermentations, which are likewise due to vegetable sporules, of different species; while the butyric fermentation is caused by the ova of an animal, which can exist only in an atmosphere of hydrogen. The alcohol we are now dealing with is called *ethyl* alcohol, to distinguish it from other alcohols obtained from other sources. Thus, an alcohol can be obtained by the dry distillation of wood, which is called *methyl* alcohol, methylated spirit, or wood spirit, which is commonly used in the arts, as a cheap substitute for spirits of wine or ethyl alcohol. Again, the potato yields an alcohol called *amyl* alcohol, potato spirit, or fusel oil. All these varieties contain the same constituents, but in different proportions, and are therefore *isomeric*. They differ in specific gravity, solubility, volatility, and in their action upon the human system. They boil at different temperatures. Rectified ethyl alcohol boils at 172° Fah. (77 C). Methyl alcohol boils at a still lower temperature —140 F. (60 C) and when placed in an exhausted tube, as the "pulse" glass, boils with the heat of the hand. Amyl alcohol is very heavy, and does not boil below 270 F., or 58° above the boiling-point of water. The heaviest of these alcohols is methyl alcohol, or wood spirit. Water being taken as 1000, the specific gravity of this spirit is 814, while that of ethyl alcohol is only 792. Fusel oil is nearly as heavy as wood spirit, having a density of 811. As our glass of wine contains, or ought to contain, only ethylic alcohol, we shall leave the other varieties out of consideration. We have seen that the composition of common alcohol is C_2H_6O. This is regarded as a radical C_2H_5 combined with the elements of water, HO, one equivalent of H in H_2O being replaced. To this radical the name of ethyl is given, hence the term ethyl alcohol in the same way. Methylated spirit is supposed to consist of a radical methyl combined with the elements of water.

Now the formula for water is H_2O, so that the radical ethyl has replaced one of the equivalents of hydrogen; hence we may call alcohol a hydrated oxide of ethyl. We have said that the alcohol of wine is derived from the grape sugar. The more sugar there is in the fruit, the richer in alcohol will be the wine produced. Thus the luscious grapes of Spain and Portugal produce the strongest wines; while the more acid fruit of France and Germany produce wines proportionately poorer in alcohol. British wines again are still weaker, and require not only the addition of sugar to disguise the acidity, but also of alcohol to prevent acetous fermentation.

The vine is cultivated in warm latitudes all over the world. On the equator itself in South America it is grown for the purpose of making wine; and in Hindostan it is met with at an elevation of 8000 ft. Marsala or Sicilian sherry is made from grapes grown upon the sides of Mount Etna at an elevation of 5000 ft.

Having settled that our glass of wine contains alcohol, it becomes an important matter to determine how much of that body we are consuming. Port and brown sherry contain naturally about 22 per cent. of alcohol by *volume*. The distinction between volume and weight must be borne in mind; otherwise we shall be supposed to be at issue with authorities who place the percentage at a much lower figure. The proportion of alcohol in natural port and brown sherry by *weight* is about 15 per cent. Natural port and sherry, however, are hardly procurable in this country. The wine shipped to this country is almost invariably fortified by the addition of brandy, for the purpose of arresting fermentation before all the sugar has been converted into alcohol. To such an extent is this practice carried, that the percentage of alcohol is often brought up to 32 by volume. An ordinary wine-glass contains about two fluid ounces; taking our port, then, to contain 26 per cent. of alcohol by volume—a very fair average—we shall have $5\frac{1}{5}$ fluid ounces, or about $2\frac{1}{2}$ wine glasses of pure alcohol to the pint of 20 ounces. Supposing our wine-glass to hold the tenth part of a pint, then our glass of port or sherry will contain abouth one-fourth of its bulk of alcohol. Madeira comes next in strength, and contains from 18 to 20 per cent. of alcohol. The light wines of France and Germany average 10 per cent., while champagne has 12 to 14 per cent. of alcohol. Instruments for determining the amount of alcohol in spirituous liquors is called an "Alcoholometer." It is simply a hydrometer which sinks more or less in a liquid according to its specific gravity. The greater the proportion of alcohol, the lighter is the liquid in relation to water; and the deeper will the instrument sink in it. These instruments, therefore, determine the alcoholic strength by weight, and not by volume.

ENGLISH SEASIDE HEALTH-RESORTS.

By Alfred Haviland, M.R.C.S., F.R.M.C.S. Lond.

CLASSIFICATION (*Continued from page* 177).

LAND and Sea Winds. A very natural question arises in the minds of many health-seekers as they stand by the sea, and look towards the horizon it forms. It is, "What is the land opposite, that is separated from us by the arc of the vast expanse of waters before us, as they curve around the earth, and clothe it in obedience to the grand law of gravitation?" Outliers, as the British isles are of the great Europ-Asian continent, and lying, as they do, in the North Atlantic ocean, the answer will, of course, depend upon the position of the standpoint whence the speculative survey is made. The question is no idle one, for it involves another of greater importance—viz., do the winds, which blow towards us, come to us after having travelled over thousands of miles of deep sea, or have they lingered in their course over the vast continent from which we are detached, and reached the shore on which we stand, after traversing the narrow and shallow channels which embrace us on two of the three sides of England.

The climate chart at page 163, and the "weather charts" that are now published weekly in Knowledge, will help us to understand the relation that our eastern and southern coast-lines bear to the lands which flank us on those sides. We must, therefore, refer our readers to them, whilst we briefly dwell upon this, the first division of our subject.

We will take the *east coast* first, from the south bank of the Tweed to the North Foreland, and, for simplicity sake, will only use the ordinary eight points of the compass—N., NE., E., SE., S., SW., W., and NW.

North.—From Berwick to Lowestoft (16); on facing this point we have the sea, uninterrupted by land, stretching to its North Polar ice-boundary; the wind, therefore, in passing from the arctic regions would cross the path of the gulf stream as it flows from the north-western side of the Shetland to wash the north-west coast of Norway, and within these gulf stream longitudes would traverse the 60° N. Lat., where it would meet with a mean air-temperature even in the coldest month of the year, January of 33° 60 Fahr., or an amount of heat 37° 04 greater than that of the mean of all other longitudes in the same parallel. Thus we see how the influence of this wonderful stream is brought to our eastern coast over our North Sea, by even the north wind. The mean January temperature within gulf stream longitudes at 60° N. Lat., being 33° 60 F., as compared with −3° 44 within all other longitudes.

On the other hand, we find that at the same point in the gulf stream in July, the mean air temperature, according to Ferrel's researches, would be 57° 40, as compared with 56° 94 within all other longitudes, or only a difference of 0° 46 Fahr.

If we take a good representative meteorological station in the North Sea, such as Scarborough, we shall find that the *North* wind is the prevailing *sea wind* throughout the year. Thus, from the observations kindly furnished us by Mr. W. C. Hughes, F.M.S., we find that, during the five years 1877-81, the number of days it blew amounted to 35° 19 per cent. of the aggregate during which these winds prevailed. Thus, within the interlatitudinal zone II., in which this health-resort lies, the sea winds are as follows, with the percentage of their prevalence:—N., 35·19.; E., 24·73; N.W., 15·93; S.E., 12·11; N.E., 12·00. The *North* wind at this station is least prevalent in *winter* (Dec., Jan., Feb.), 14·1 per cent., and most so in the *spring* (March, April, May), 30·6 per cent., culminating in May; in *summer* (June, July, Aug.), 29·1 per cent., and in *autumn* (Sept., Oct., Nov.), 26·3 per cent.; so that in the North Sea it may be said to be rather equably distributed throughout the seasons and the year generally. It may be added that the above winds are the *sea* winds along this line of coast between the two points indicated.

North-East.—Norway and Sweden are the countries which oppose an observer on this coast looking in this direction, and over these countries *some* of our north-east winds have travelled before crossing the North Sea to reach our shores. We say *some*, because it is now well established that these and other winds in different parts of their circuits

appear to have very different directions. From observations extending over ten years at the following stations on the Norwegian and Swedish coasts, it appears that the mean air temperature in January at the point of departure of these winds is 33° 5, or 3° 5 less than the isotherm of our west coast (37°) during the same month. Thus Christiansund, 63° 7′ Lat. N. has a mean monthly air temperature of 34° 3 Fahr.; Bergen, 60° 24′ Lat. N. 33° 3; Skudenses, 59° 9′ Lat. N. 34° 7; and Mandal, 58° 2′ Lat. N., 31° 8. In passing it may be noted that Mandal, although the most southern of these stations, has a mean January temperature 1° 5 colder than the most northern, Christiansund, which being on the north-western coast of Sweden, has the immediate benefit of the gulf stream. These stations in summer (July) have a mean temperature of 55° 4, or 5° 1 lower than the mean of the four isothermals, 59°, 60°, 61°, and 62°, between Berwick and Cromer; hence the cooling and refreshing influence of this sea wind in the height of summer on our east coast. It must now be observed that, at a time when the gulf stream influence is *nil*, and the sun-heat all powerful on the land, the most southern station, Mandal, has a mean air temperature of 58° 9, whilst that of the most northern, Christiansund, is only 54° 4, or a difference of 4° 5. This north-east wind has a large marine element in it.

On the east coast it is the least prevalent of the sea winds; it begins to become more frequent in March, and generally reaches its maximum in April and May. Compared with the other sea winds we have seen that the percentage of its prevalence is 12·00 throughout the year. During the months of its greatest prevalence, the Norwegian and Swedish stations have a mean air temperature of 40° 5 in April, and in May 46° 6, while the mean of the isotherms between Berwick and Cromer are 46° 8 in April and 52° 0 in May, the temperature of the sea for these months being about 42° 7 and 46° 3 respectively. Thus it is that the days on which this wind blows, a depression in the air temperature is experienced. It is the wind that brings what are called "black frosts" as distinguished from the "white," or hoar frosts, which are eminently local in their character, and the result of unchecked heat radiation under a serene sky. The north-east wind before it reaches our shores has to travel over six or seven hundred miles of sea.

The western part of Europe must now engage our attention, as over it blows the wind which of all others exercises the most important effects upon our country. The observer as he travels from north to south along our east coast will have opposite to him, within the interlatitudinal zone I., Denmark, with its two stations, Tarm and Copenhagen; within zones II. and III., the coast of Germany which unites Denmark with the Netherlands; within zone IV. the Netherlands; and zone V. Belgium. This coast line is the western boundary of the great central plain of Europe, which is walled in on the east by the Ural mountains, stretching from the north to the south of Europe. A wind that has traversed such a plain before reaching our shores must have had its marine character entirely altered, and it is a most important question whether, and under what circumstances, its short sea passage enables it to recover its title to be called a sea wind. This we shall reserve for our next paper.

Next to California, Australia is the most productive of gold-bearing countries. The gold-bearing territory of Victoria alone is estimated at 28,000 square miles; of New South Wales, 13,650; and of Queensland, 14,600 square miles. As in the Rocky Mountain mining districts, gold is found both in quartz-rock and placers; but, like the mines of California, those of Australia are becoming every year less productive.

ELECTRIC LIGHTING AND ITS RISKS.

THE rapid development of electric lighting which we have witnessed during the past year or two has, as might have been anticipated, been accompanied by more or less important misadventures. Roughly speaking, these may be divided into two classes—first, accidents to the body; second, accidents to property. A few efforts have been made to formulate and help guard against the recurrence of these accidents, the causes for which are, in the great majority of cases, easily discernible by practical electricians. There is, however, hardly a subject so important and so frequently ignored by amateurs and unpractical men generally as the necessary methods for confining the electric current to the channel through which its course is intended to lie. Its importance is comparable to the necessity of making strong boilers to confine steam, or of thoroughly washing the glass and other apparatus in the hands of the amateur or professional chemist.

If the electricity is properly confined or insulated, the chances of danger to the body are reduced to a minimum. These dangers arise only from currents of high intensity such as are used for arc lights; and the wires transmitting such electricity should not only be carefully insulated, but should be fixed in such a way as to prevent the comparatively soft insulating being rubbed away by friction against the corners of houses, tunnels, chimney-stacks, &c. It would be well if some competent authority were employed by Government to fix a legal minimum amount of insulation, and to stipulate with the various companies that frequent, careful, and trustworthy tests should be taken. Were this done, we should hear nothing of such accidents as that which occurred at Hatfield, and which we cannot stigmatise in milder terms than by calling it barbarous. Should such an authority be appointed, one of its most important duties will be to see that the earth is rarely, if ever, used as a return wire. The dangers to property are of a very different kind. They result from the volume or quantity of the current. When this gets to be more than the conductor can sustain, it becomes hot, and may eventually set fire to the building. This we know to have frequently happened, and as it is not always possible to guard against a current getting too large for the conductor, an automatic device should be invariably inserted by which the circuit is broken and the current no longer allowed to flow. In certain places great stress is laid on a regulation that the conductors should be at a considerable distance from each other, but where proper means are taken to ensure thorough insulation, this becomes unnecessary. Whether anyone is ever appointed for this particular work or not, it is certainly to be hoped that we shall soon have something more definite than the generalisation to which we were indulged in the report we published a week or two ago. The gross ignorance displayed by very many electric light engineers (!) demands this, and the sooner something is done, the better will it be for the vendor as well as for the buyer.

LEARNING TO SWIM.

By Natator.

(*Continued from page* 180.)

HAVING acquired the art of balancing easily in the water, body aslant, back uppermost, you are practically master of the situation; for, while the balancing comes easier at every trial, many ways of making progress come naturally to you. For instance, if you put the

palms of the hands together, and so thrust them forward, then separating them and forming each hand into a cup-shaped paddle, in the way already described, you carry them with a wide sweep backward, so that the hand-paddles drive back as much water as possible, you are, of course, carried forward; and you can repeat this action as often as you like, without using the legs at all. Or again, if you let your arms and hands simply wave about in front of you, keeping your balance, you can use your legs and feet in a rough-and-ready way to propel you, drawing the feet up under you aslant to the water, and kicking them back square to the water. Or you can progress more systematically by the process called "swimming like a dog," in which each hand is alternately slid forward, points of the fingers first, as far as it will go, and then drawn strongly back, held downward from the wrist in the cup-paddle form, while the legs also move alternately to give a kind of slow, backward kick, like that already described. In these and many other ways you can now get about in the water, not very quickly, but probably as fast as you want to go, and quite safely,—though, of course, it is well not to go out of your depth.

Still, this is not to be called swimming. If you want to swim well, you must learn from the beginning a good style,—which really means the sound, scientific application of the methods of progression possible in the water. That you may the better do this, do not be in a hurry; but first practise several things which will increase your confidence in the water, and enable you, when you do begin to learn the true swimming strokes—the breast stroke and the side stroke—to give your whole attention to style.

First, then, learn how to float on the back.

This is easier by far than learning to balance with the back uppermost (and the mouth out of water—a desirable state of things for those who prefer to breathe). But it is not right to learn *first* to float on the back, just because it is so easy that the learner is apt to stop there, and make no further progress. Besides, in turning from back floating to front floating, it is just as well to be able comfortably to balance in the latter position, and not be obliged ignominiously to splutter and struggle into a standing position.

Standing up to the breast in the water, *your back towards the shore*, hold the arms out on either side, or inclined rather upwards and backwards, lean gently backwards—further and further, until the arms and the back of the head enter the water: you leave the ground, and at the first few trials you feel as if your head and shoulders *must* dip under. But they *cannot* do it, even if you try. The odd thing is that when you lean forward from a standing position in the water, you feel as if you could readily balance yourself, yet as soon as the feet leave the ground the beginner invariably goes head under, but when you lean backwards with the arms outstretched, you feel as if you were surely going under, yet as soon as the feet leave the ground you find yourself lying as comfortably on the water as if you were on a feather bed. There is scarcely any tendency to roll sideways, and what there is is very easily controlled by the hands in the water. But so little is there that after the first few trials you can put your arms or hands under the back of the head and float on your back as if you were going to sleep in that position on the greensward.

To progress in any required direction, when floating on the back, is exceedingly easy. You can hold the arms easily alongside and work the hands from the wrist, "cupping" them for greater driving action, if necessary, or you can use the arms more freely, taking advantage of their full sweep. The legs can be used by gentle kicking, slanting the feet as you draw them up for the kick, and squaring them against the water as you give it. But you can now try a method of propulsion with the legs, which will prove much better, and give you an insight into the true principle of leg propulsion in swimming. Floating on the back, gently draw up both legs, and kick them out simultaneously as far apart as you conveniently can; there then lies between them a triangular space of water. Bring them now, still extended, close together, forcing out, of course, towards the feet, the water which had lain between them (the action is like closing the blades of a pair of scissors). This action, you will find, produces a strong propulsive effect,—the forcing of the water backwards urges, in fact, the body forwards.

While learning these preliminary exercises in order to acquire a good swimming style, both for breast-stroke and side-stroke, learn to roll over easily from the back to either side, and from the side to the front, until you feel as little care about any of these movements as you would about the corresponding movements in bed. To make them more difficult, change your floating positions from back to front either way *after* expelling the air from the lungs, being careful, however, to do this at first only in shallow water; for though, after a little time, no difficulty whatever is found in bringing the mouth above water when the lungs are exhausted, it is, at first, rather discomfiting to find how very little floating power remains after the air has been expelled. I have seen a learner very much confused by the depressing effect of a hearty laugh in which he had indulged when floating. But of course, after a little experience, the learner finds out the advantage of keeping his floating apparatus, the lungs, well filled with air. It also does not take him long to learn that it is not quite the right time to replenish them when the mouth is under water.

(To be continued.)

BUTTERFLY PRINTING.

By E. N. Parker.

BEFORE commencing a description of this (to my mind) most useful way of preserving butterflies and moths, I may perhaps be allowed to mention that "Butterfly Printing" is not an exact term for the method, which should be more properly described as "Butterfly Gumming," or by some longer collection of words, which I will leave to your readers to put together for themselves.

The best time for the work will be found to be during the long winter evenings at home, after the collecting season is over; but I think this description is timely now, as a number of specimens of the common sorts can be captured, and used for practice and gaining experience in the method about to be described, without which the collector would, no doubt, hesitate some time (and with reason) before using his perhaps solitary specimen of some rare species, taken after the expenditure of a large amount of time, trouble, and, possibly, money.

The materials are few and simple, and all that will be found absolutely necessary are two common penny paint-brushes of camel-hair (so-called) one large and one small, an ounce of gum arabic, and a quire of thick cream-laid note-paper, a pair of tweezers, which should be pointed bluntly and slightly bent, so that the points meet when squeezed without the rest of the instrument touching (or a pair of tweezers taken from the microscope box, slightly bent in the same way, will answer as well); a tumbler or wineglass broken across the stem, and a few sheets of thick blotting-paper torn into strips of about 6 in. long by 2 in. broad.

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Our butterfly caught, killed in the usual manner, impaled and brought home, all the material being made ready, and the gum dissolved in cold water and strained through a piece of muslin, the operator must take it (holding tightly) by the pin, in the left hand, and with a sharp knife or pair of scissors cut off the four wings as closely as possible to the body, letting them drop on a clean sheet of ordinary paper.

The next step is to take the tweezers and arrange the wings with the underside uppermost, and place the tumbler over them to prevent a breath of air moving them.

Then take a half-sheet of note-paper and fold it across the middle, and having opened it again, smear it over about half the surface towards the middle of the paper with the gum; hold it by the edge with the left hand, fingers lengthwise, and with the second finger of the right hand distribute the gum over the paper, pushing it from left to right, and then turning the paper round and doing the same, until on holding it up and looking at it sideways in the light no lines can be seen. Place the paper breadthwise before you; and with the tweezers arrange the wings on the nearest half of the gummed paper, placing first the upper wings and then the lower wings as they would appear when the insect is "set" in the usual manner, leaving, however, room for the body, which must be carefully preserved and ticketed in a manner which will show what wings it belongs to.

Having arranged the wings, which, once placed, must not be again moved under pain of the specimen being spoilt, fold over the paper, let it stick together, and rub hard on the outsides, top and bottom, where the wings are placed, with a pocket-handkerchief over the finger. Open the paper, remove the wings, which may be done by blowing or lifting them gently and carefully with the tweezers from the end nearest the body, and all the scales will be found to have stuck to the paper in order as on the butterfly itself, there being an upper and under view.

After this, the paper must be washed over with clean water, to remove the gum (being careful to go close up to, but not over, the scales), using the blotting paper to absorb it, and, when the surface is quite clean, placed in a heavy book to press and dry.

When thoroughly dry (in about half-an-hour) commence to paint in, with ordinary water-colours, the body, between the wings, to do which well, and get a good copy, will require some practice.

When this is finished, the paper may be cut in two and stuck into a scrap album with thick cardboard leaves; the species, upper or under wing, being written in one corner, and the place and date of capture in the other, or as the collector's fancy may dictate.

The great utility of this system appears to me to be that specimens are free from any chance of being destroyed by moths or dust when by accident the necessary supply of camphor is forgotten to be renewed, and a much more portable collection is obtained, which can be laid on the drawing-room table, carried about, or even dropped, without danger to the specimens.

I have transferred to paper in this manner a number of West Indian butterflies caught more than fifty years ago, and given to me in various stages of decay and destruction.

One fact has been revealed to me by this process which I did not know before, and that is that most butterflies and moths have two sets of scales and fringe round the borders of the wings. This is proved by the fringe being perfect on both the upper and under view, and by the fact that I have once or twice been able, with great care, to take two impressions from the same wings.

In every case but one, I have found the above-described method to be successful, and that one failure is in the blue butterflies, of which the under sides of the scales (which appear uppermost on the print), are of a whitey-blue colour, and not the bright tint which we see so often flitting about our fields.

I trust that I have made the above fairly plain, though not so short as I or you might have wished; but if any of your readers find a difficulty in carrying out the directions, I shall be pleased to answer any questions they may like to put. The key to the whole thing is the consistence of the gum and delicacy of touch.

HAS THE MOON AN ATMOSPHERE?

By Mr. Ranyard.

NO lunar clouds are ever seen floating over the sharply-defined objects of the lunar landscape. As the sun rises upon the moon, the transition from darkness to light is quite sudden. No zone of twilight stretching beyond the sun-illuminated region can be detected, and as the moon passes over bright stars, there is no gradual diminution of their light as they approach the lunar limb, but they disappear suddenly, as if snuffed out, at the instant that the lunar limb covers them. It is quite certain, therefore, that the moon has not a vapour-laden atmosphere which is as dense, or nearly as dense, as the atmosphere which envelopes the earth. There is no evidence tending to show that rays of light are bent as they graze the lunar limb. Rays grazing the earth's surface in a similar manner would be turned through an angle of more than a degree from their original course by refraction in the earth's atmosphere, for it is known that stars, when seen upon the horizon, are raised more than half-a-degree above their true places by the bending which rays of light undergo before they reach the observer. If there were any such refraction of light by a lunar atmosphere, the sun would never be entirely hidden by the dark body of the moon during an eclipse. During the recent total eclipse, as seen from Sohag, the moon's diameter was about half-a-minute of arc greater than the sun's diameter, and at the time of central eclipse, when the centre of the moon's disc coincided with the centre of the sun's disc, the sun's limb would have remained visible if there had been a lunar atmosphere giving a refraction equal to 1-240th part of the refraction which would have been caused by the earth's atmosphere. But not only was the sun's limb hidden at the time of central eclipse, but it remained hidden for more than a minute—in fact, the observed duration of totality agreed within a few seconds with the duration calculated on the supposition that there is no bending of light by a lunar atmosphere.

There is always some discordance amongst observers as to the actual duration of totality, for the disappearance of the sun's light is not an absolutely instantaneous phenomenon, so that occasionally trained observers standing beside one another differ as much as three or four seconds in their estimates of the time of the commencement of the total phase. There is also some uncertainty as to the real diameters of the sun and moon. But after making allowance for these uncertainties, we may safely assert that the observed duration of total eclipses agrees with the calculated duration sufficiently closely to enable us to be sure that there is not an atmosphere about the moon capable of causing a refraction equal to one two-thousandth part of the refraction which would be caused by the earth's atmosphere under similar circumstances.

But this does not prove that there is no lunar atmosphere, or even that there is not a lunar atmosphere equal

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STARS FOR SEPTEMBER

OUR STAR MAP.—The circular boundary of the map represents the horizon. The map shows also the position of the equator and of that portion of the Zodiac now most favourably situated for observation. The names of ninety-nine stars of the first three magnitudes are given below.

On Aug. 29, at 10·30 p.m.
On Sept. 2, at 10·15 p.m.
On Sept. 6, at 10· 0 p.m.
On Sept. 10, at 9·45 p.m.
On Sept. 14, at 9·30 p.m.
On Sept. 17, at 9·15 p.m.
On Sept. 21, at 9· 0 p.m.
On Sept. 25, at 8·45 p.m.
On Sept. 29, at 8·30 p.m.

ARABIC NAMES OF STARS.

The following table exhibits the names of all the stars of the first three magnitudes whose names are in common use:—

α	Andromedæ	*Alpheratz*
β	———	*Mirach, Mizar*
γ	———	*Almach*
α	Aquarii	*Sadalmelik*
β	———	*Sadalsund*
δ	———	*Skat*
α	Aquilæ	*Altair*
β	———	*Alshain*
γ	———	*Tarazed*
α	Arietis	*Hamal*
β	———	*Sheratan*
γ	———	*Mesartim*
α	Aurigæ	*Capella*
β	———	*Menkalinan*
α	Boötis	*Arcturus*
β	———	*Nekkar*
ϵ	———	*Izar, Mizar, Mirach*
η	———	*Muphrid*
α	Canum Venat. ...	*Cor Caroli*
α	Canis Majoris ...	*Sirius*
β	———	*Mirzam*
ϵ	———	*Adara*
α	Canis Minoris ...	*Procyon*
β	———	*Gomeisa*
α^2	Capricorni ...	*Secunda Giedi*
δ	———	*Deneb Algiedi*

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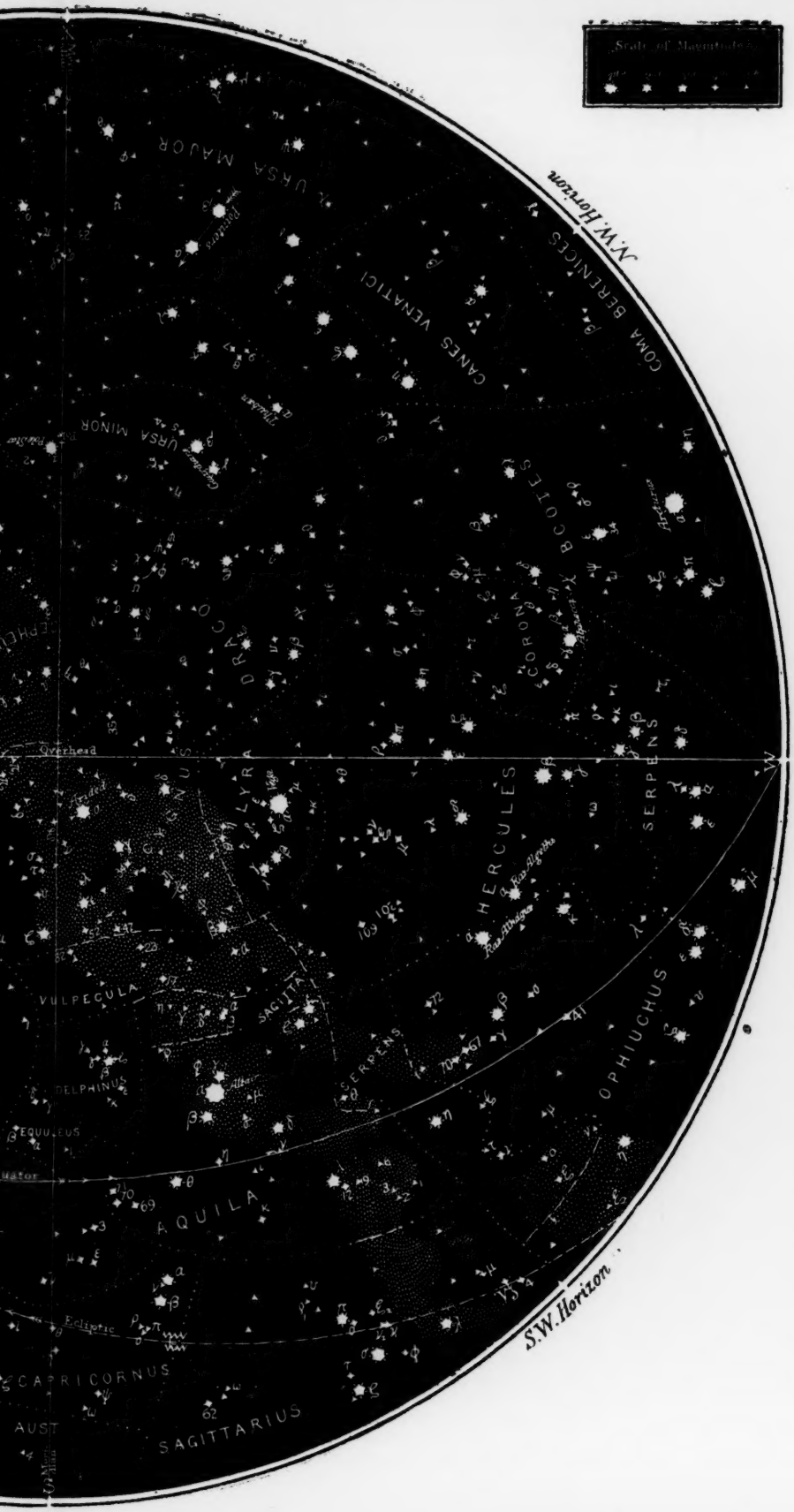

α	Cassiopeiæ	*Schedar*
β	———	*Chaph*
α	Cephei	*Alderamin*
β	———	*Alphirk*
γ	———	*Errai*
α	Ceti	*Menkar*
β	———	*Diphda*
ζ	———	*Baten Kaitos*
ο	———	*Mira*
α	Columbæ	*Phact*
α	Coronæ Borealis	*Alphecca*
α	Corvi	*Alchiba*
δ	———	*Algorex*
α	Crateris	*Alkes*
α	Cygni	*Arided, Deneb Adige*
β	———	*Albireo*
α	Draconis	*Thuban*
β	———	*Alwaid*
γ	———	*Etanin*
β	Eridani	*Cursa*
γ	———	*Zaurac*
α	Geminorum	*Castor*
β	———	*Pollux*
ζ	———	*Alhena*
δ	———	*Wasat*
ε	———	*Mebsuta*
α	Herculis	*Ras Algethi*
β	———	*Korneforos*
α	Hydræ	*Alphard, Cor Hydræ*
α	Leonis	*Regulus, Cor Leonis*
β	———	*Leneb Alest, Denebola, Deneb*
γ	———	*Algeiba*
δ	———	*Zosma*
α	Leporis	*Arneb*
α	Libræ	*Zuben el Genubi*
β	———	*Zuben el Chamali*
γ	———	*Zuben Hakrabi*
α	Lyræ	*Vega*
β	———	*Sheliak*
γ	———	*Sulaphat*
α	Ophiuchi	*Ras Alhague*
β	———	*Cebalrai*
α	Orionis	*Betelgeux*
β	———	*Rigel*
γ	———	*Bellatrix*
δ	———	*Mintaka*
ε	———	*Alnilam*
α	Pegasi	*Markab*
β	———	*Scheat*
γ	———	*Algenib*
ε	———	*Enif*
ζ	———	*Homan*
α	Persei	*Mirfak*
β	———	*Algol*
α	Piscis Australis	*Fomalhaut*
ε	Sagittarii	*Kaus Australis*
α	Scorpionis	*Antares, Cor Scorpionis*
α	Serpentis	*Unukalhai*
α	Tauri	*Aldebaran*
β	———	*Nath*
η	———	*Alcyone* (Pleiad)
α	Ursæ Majoris	*Dubhe*
β	———	*Merak*
γ	———	*Phecda*
ε	———	*Alioth*
ζ	———	*Mizar*
η	———	*Alkaid, Benetnasch*
ι	———	*Talitha*
α	Ursæ Minoris	*Polaris*
β	———	*Kochab*
α	Virginis	*Spica Azimech, Spica*
β	———	*Zavijava*
ε	———	*Vindemiatrix*

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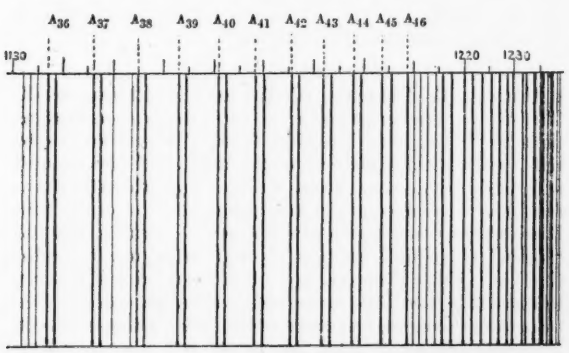
to one five-hundredth part of the terrestrial atmosphere, for the mass of the moon is less that one-eightieth part of the earth's mass, so that the weight of a body at the moon's surface is less than one-fifth of the weight it would have upon the earth's surface. And an atmosphere like our own would, if removed to the moon (the temperature remaining the same), be more loosely packed, and would extend to a much greater height above the surface.

There is another method by which the existence of a lunar atmosphere may possibly be detected. Besides bending rays of light, the earth's atmosphere absorbs certain wave lengths more than others, so that in the spectrum of sunlight which has passed through the lower strata of the atmosphere for some distance, as at sunrise or sunset, there are certain lines which are not to be found in the spectrum of a high sun. M. Thollon, who was one of the observers of the total eclipse at Sohag, has spent many years in making a great map of the solar spectrum, in which he has laid down the position and relative intensities of the solar lines, and he has also mapped down the places of many hundreds of atmospheric lines which are proved not to belong to the true solar spectrum, because they grow more intense as the sun sinks towards the horizon, and vary with the amount of aqueous vapour present in the atmosphere.

The instrument with which M. Thollon has made his observations is a bisulphide of carbon spectroscope, giving a dispersion equivalent to thirty-one prisms of 60° of ordinarily dense flint glass, and giving a much brighter spectrum and far better definition than could be obtained with such a cumbersome train of prisms, if it were possible to mount them and keep them in adjustment. M. Thollon has in a very simple manner contrived to make the solar rays pass three times through a system of prisms and half-prisms, so that the eye-piece of the viewing telescope and the slit remain fixed, while by a motion of the prisms, different parts of the spectrum can be brought into view. M. Thollon has made with this instrument a map of the solar spectrum 49 feet long, showing more than 4,000 lines.



The wood-cut, copied from one of M. Thollon's drawings, represents the well-known B group, which lies towards the red end of the spectrum. It is a group which is modified in a most striking manner by atmospheric absorption.

During the total solar eclipse of July, 1878, Professor C. A. Young examined this region of the solar spectrum with the slit, of his spectroscope placed upon the image of the solar crescent, so that light from the sun's disc entered one half of the slit while the other half of the slit was upon the image of the dark moon. On looking into the eye-piece of his spectroscope a brilliant solar spectrum was seen in the half of the field corresponding to the half of the slit which was upon the sun's disc, while the other half of the field appeared quite black. The division between the two halves of the field was exceedingly sharp. There was no gradual dimming of the solar spectrum close to the moon's limb, and Professor Young was not able to recognise any of the well-marked terrestrial absorption lines, or any new lines in the solar spectrum, though he spent some time in carefully examining the region close to the moon's limb.

Professor Young's observation was made with a grating spectroscope of 17,300 lines to the inch, which in the spectrum observed gave a dispersion about equal to the dispersion of M. Thollon's liquid spectroscope; but the amount of light and the sharp definition obtainable with Professor Young's instrument was not equal to that given by M. Thollon's instrument.

It will be seen that the light which enters the slit close to the moon's limb must, if there be a lunar atmosphere, have passed through the densest portions of it; but although the air of Colorado, where the observation was made, was very dry (and the sun was at a considerable altitude, more than 41° above the horizon, so that there would be very little absorption taking place in the earth's atmosphere, and the lunar absorption lines, if any, ought by contrast to have been well shown), Professor Young was unable to detect any trace of absorption. I was observing near to him, and he kindly gave me an opportunity of looking through his instrument. I was much struck by the sudden transition from the ordinary solar spectrum to utter darkness, a transition totally unlike that which is observed when the slit lies across the nucleus of a sun spot. The edge of the spectrum was much more strikingly abrupt and sharply defined than the edge of the spectrum which corresponds to the sun's limb when the slit is placed radially on the uneclipsed sun so as to project beyond the solar disc, and the dark lines of the solar spectrum were sharply cut off, apparently without alteration. No evidence, therefore, was obtained by Professor Young tending to show that any absorption of recognisable amount takes place at the lunar limb. In our next article we will examine the evidence which was obtained by MM. Thollon and Trépied during the recent total eclipse which they observed in the dry air of Upper Egypt.

(To be continued.)

A Super-Sensitive Thermometer.—Since the days when Mr. Edison brought out his micro-tasimeter, which proved so sensitive to heat, until now, we have had no instrument devised for measuring extremely delicate changes of temperature. Such an apparatus has, however, been recently devised by M. Michelson, and brought, at least in its experimental form, before the French Physical Society. It is based on the principle of bi-metallic thermometers, but ebonite or hard caoutchouc is chosen instead of one metal. Hard rubber is ten times more dilatable than platinum under heat, and a spring composed of platinum on one side and ebonite on the other will curve under the least increase of temperature. At the extremity of the spring is fixed a small glass stem, forming an elbowed lever, which abuts against a light mirror suspended by a silk fibre. When the spring curves or straightens, the mirror is deflected, and a ray of light from a lamp reflected from its surface to a scale moves up or down the divisions of the scale. By giving to the spring and lever a relatively great length, this instrument can be made very sensitive, and the inventor hopes to be able to measure the thousandth of a degree Centigrade.—*Engineering.*

XUM

Reviews.

TWO ELEMENTARY BOTANY BOOKS.*

THERE is nothing harder on earth than to find fault, and especially to find fault with established authority. If possible, one would like to praise everybody, and above all to praise earnest men of science, whose title to speak about their own special subject is quite undoubted. But we cannot find it in our hearts not to utter a word of protest against Professor Bentley's little manual, which he has prepared "with the intention of supplying young boys and girls with a simple introduction to the study of plants." It is meant to be "quite intelligible to any boy or girl beyond the age of twelve years, who has even received but a moderately good education." And here is some of the fare provided for the phenomenal boys and girls beyond the age of twelve years:—

> Thus, if the blade is pinnately-veined the divisions are correspondingly placed, and the leaf is *pinnatifid, pinnatipartite*, or *pinnatisected*, according to their depth; or when palmately-veined and divided accordingly the leaf is *palmatifid, palmatipartite*, or *palmatisected*, in like manner. When the divisions are themselves divided in a similar manner to the blade itself the leaf is *bipinnatifid*, &c., the application of which terms will be readily understood without further explanation.

Elsewhere, from a single page of this little primer, we extract the following choice expressions:—"Coiled up in a circinate manner," "young flowers in a scorpioid cyme," "sori," "inclusium," "sporangia," "a ring or annulus," "antheridium," "spirally-waved filament termed a spermatozoid," and so forth; while the next page takes us into all the dry details of archegonia, embryo sacs, germ cells, and the rest of it, which, as Mr. Silas Wegg justly remarked, had much better be discussed "in the absence of Mrs. Boffin." Organography, morphology, alternation of generation—this is what the boys and girls above the age of twelve years have to study. And yet they have received but a moderately good education! Why, Macaulay's famous schoolboy was but an ignoramus by the side of these modern prodigies!

The anonymous author of "Plant Life," seems almost equally unable to think himself away from the technicalities wherein he was instructed, and to think himself into the position of the hapless children for whose instruction he is supposed to write. It is true, he has been heavily weighted by the "requirements of the Education Department, as published in the Revised Code": and certainly the collective wisdom which prescribes an acquaintance with cells and vessels or the phenomena of germination deserves to be treated with deferential caution; but even that awful and impersonal entity, the Revised Code itself, could hardly desire that the babes and sucklings of the Board Schools should be crammed with such solid pudding as this:—

> Within is a cellular body, each cell of which contains a curled-up *antherozoid*. These antherozoids, when set free, find their way into the *archegonium* and fertilise it, the result being that growth is excited in a portion of the *archegonium* called the nucleus. It developes into the *sporangia*, and in so doing tears away the upper part of the *archegonium* which remains attached to it as the *calyptra*. From these instances it will be seen that a variety of reproduction obtains among the *cryptogamic* plants.

All this is very true and very beautiful, no doubt; but as we read it we wonder, somehow, whether it would not be possible to write a botany book for children in a simpler, pleasanter, and more natural way. Might not one begin with the pretty pink flower itself, the thing that little children know and love, instead of beginning with "the root or descending axis," and proceeding duly to the andræcium and the gynæcium, and all the other horrid structural details? Might not one explain first the use and meaning of flower and fruit, and then work back to leaf, and stem, and root, and cells, and vessels? Might not one do all this, with the accompaniment of some simple diagrams, and yet never once employ such charming words as lyrete, runcinate, palmate, digitate, and pedate? But, then, a botany book written upon those lines would perhaps be actually interesting, and what would the Revised Code say to that? No, collective wisdom is all for the best, no doubt; and the poor children must go on with these weak and beggarly elements to the very last. Yet, we venture to predict that all the good they will ever get from them will be a profound and deeply-rooted hatred of systematic botany.

"The Botanical Atlas; a Guide to the Practical Study of Plants." By D. McAlpine, F.C.S. (Edinburgh: W. & A. K. Johnston, 1882. Part I.) This is a capital work of its sort, well designed and well printed, with most of its information brought thoroughly up to date. It consists of dissections and magnified views of illustrative plants, which will show practical students what they ought to see for themselves in the specimens they examine. Not only is the structure of each species well exhibited, but attention is called in passing to functional uses, while such points as the devices for favouring or ensuring cross-fertilisation in the sage and the wallflowers are admirably brought out in the drawings and enforced in the letter-press. Here and there we notice a little vagueness of detail in the essential organs of the flowers represented, and the descriptive literary matter requires more careful editing; but we hope to see these slight defects remedied in forthcoming parts, and we can cordially recommend the work to all amateurs or beginners who wish for a guide in the difficult matter of plant dissection. It is prettily coloured, too, which gives it the first introduction of a pleasing appearance, and it is commendably free from any unnecessary technicality of language.

Mrs. R. C. Barnard, of Bartlow, Leckhampton-hill, Cheltenham, sends us some excellent lithographed illustrations to "Houston's Practical Botany," which are to be had "only by application to the artist." They are well and faithfully drawn from nature, and the structural details have been carefully brought out. Above all, Mrs. Barnard has succeeded in catching what botanists call the "habit" of the different plants—that is to say, their distinctive individual appearance. There is nothing so difficult to do as this, for draughtsmen will often give every technical detail with perfect correctness, and yet the whole will be so unlike the real plant that nobody will recognise it for the same thing. It is like expression in portrait-painting—dependent upon such petty turns or twists of feature that only a true artist can ever catch it. For her present purpose, Mrs. Barnard may be considered as such.

According to Dr. Frankland's report upon the quality of the waters furnished to the metropolis during July, the Thames water distributed by the five companies drawing their supply from that source was of better average quality than in any previous month of the year, although all the samples, except that drawn from the mains of the Lambeth company, were slightly turbid from inefficient filtration. The Lea water, distributed by the New River and East London Companies, also showed considerable improvement in quality.

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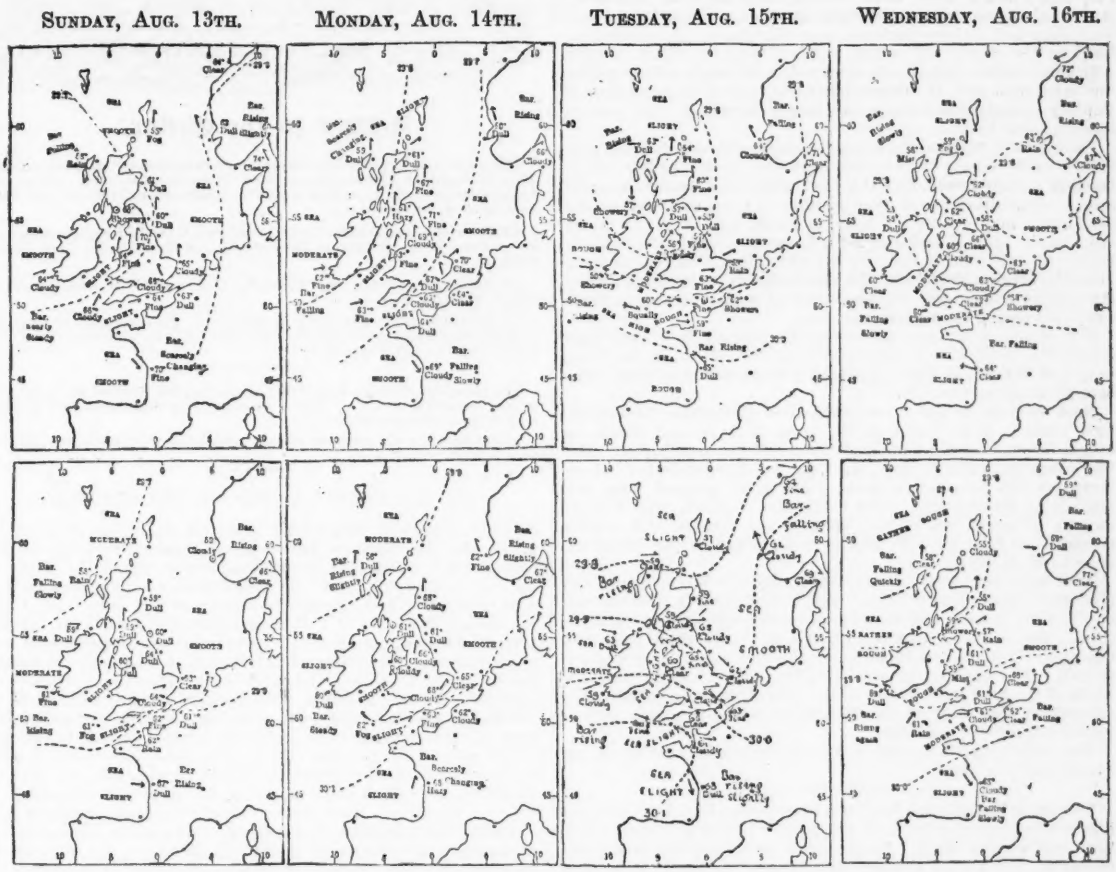
* "Manuals of Elementary Science," Botany, by Professor Bentley (S.P.C.K.). "Easy Lessons in Botany," by the author of "Plant Life." (London: T. Fisher Unwin.)

WEATHER CHARTS FOR WEEK ENDING SUNDAY, AUG. 20.



In the above charts the dotted lines are "isobars," or lines of equal barometrical pressure, the values which they indicate being given in figures at the end, thus—30·4. The shade temperature is given in figures for several places on the coast, and the weather is recorded in words. The arrows fly with the wind, the force of which is shown by the number of barbs and feathers, thus:— ⟶, light; ⟶, fresh or strong; ⟶, a gale; ⟶, a violent gale; ⊙ signifies calm. The state of the sea is noted in capital letters. The * denotes the various stations. The hour for which each chart is drawn is 6 p.m.

THE PUBLIC HEALTH.

THE Registrar-General's returns for the past week show that in London 2,670 births and 1,528 deaths were registered. Allowing for increase of population, the births exceeded by 21, while the deaths were 48 below, the average number in the corresponding week of the last ten years. The annual death-rate from all causes, which had slowly increased in the four preceding weeks from 17·7 to 19·2 per 1,000, further rose last week to 20·5. During the first seven weeks of the current quarter the death-rate averaged only 18·6 per 1,000, against 21·5 and 23·6 in the corresponding periods of 1880 and 1881. The deaths attributed to diarrhœa (including dysentery), which had been 103, 118, and 147 in the three preceding weeks, further rose last week to 164, but were 83 below the corrected average weekly number. These 164 deaths from diarrhœa included 127 of infants under one year of age, and 29 of children aged between one and five years. The fatal cases of whooping-cough, which had been 63, 57, and 44 in the three preceding weeks, rose again to 52 last week, which were 11 above the corrected weekly average; 5 occurred in St. Pancras, 4 in St. George-in-the-East, 4 in Bermondsey and Rotherhithe, and 6 in Lambeth. The deaths referred to diseases of the respiratory organs, which had steadily increased in the four preceding weeks from 157 to 223, declined again to 197 last week, but exceeded the corrected weekly average by 30; 106 were attributed to bronchitis, and 45 to pneumonia. Twelve cases of suicide were registered, which exceeded the corrected average by 4.

BUTTERFLIES AND MOTHS.

By W. J. H. Clarke.

THE PROMINENT MOTHS.

AMONG the division of Lepidoptera known as the *Cuspidates*, we find a very interesting and peculiar class of moths styled "Prominents." They derive their name from a small projecting tuft of scales on the lower margin of the upper wings, which stands out very prominently when the insect is at rest.

In England, twelve species in all have, up to the present, been found, but many are of such extreme rarity that very few cabinets possess authentic British-caught specimens of all the varieties.

The first in order is the Plumed Prominent (*Ptilophora Plumigera*), a very handsome but rare insect. It has been found in Buckinghamshire in the month of October, but only on very few occasions. The fore wings are semi-transparent, of a raw sienna

colour, with a bar of a paler hue beyond the centre. The caterpillar feeds on the maple, and is to be found in June and July.

The next species we come to is the Pale Prominent (*Ptilodontis Palpina*), which is much more common than the last. This moth is of a pale brown colour, with three bands of a darker brown, and black dots and stripes scattered over the wings. The caterpillar feeds on the poplar and sallow, and is of a green colour, covered with small raised white spots, arranged in six bands, with a yellow line down each side. It changes into a chrysalis in the beginning of October, and remains in that state during the winter. The perfect insect appears in June.

The tolerably common Coxcomb Prominent (*Notodonta Camelina*) is the next in order. It is a very handsome insect, the fore wings being of a rusty brown, and the hind wings of a similar but paler colour. The caterpillar is very peculiar in form, and feeds on the oak, birch, maple, &c.; the body is green, with worts or raised spots on the back, tipped with pink, from which issue tufts of black hairs. On each side of the body is a white line, composed of spots joined together with stripes; the caterpillar is to be found during the present month and the beginning of next. The moth itself comes out during the summer months.

The Maple Prominent (*Notodonta Cucullina*) is a very rare insect, the caterpillar of which feeds on the maple. It has been caught at Halton, in Buckinghamshire, in the month of May. The caterpillar appears in July.

Next we come to the Scarce Prominent (*Notodonta Carmelita*). This moth is to be found on the wing in April, and should be sought for on the trunks of birch-trees and places adjacent. The fore wings are reddish grey, with the upper edge darker where there are two pale yellow spots, from which proceed lines and black dots transversely. The caterpillar is green, with a large number of raised yellow dots all over the surface, and a buff-coloured line down the side, and is to be found in the month of June on birch-trees.

Next upon our list of Prominents comes the White Prominent (*Notodonta Bicolor*), a very rare and beautiful moth. It appears on the wing in June, and is said to have been captured in Staffordshire. The wings of this moth are white, with black spots and other markings, the front margin of the fore wings being slightly arched. The hind wings are light, but without spots, and the whole of the head and the rest of the body of the same colour. The caterpillar, like most of the Prominent larvæ, is green, with a yellow stripe down each side.

The remaining six species will be described in next paper, as space forbids in this.

Professor Tommasi has written a letter to the *Piccola*, describing a case of hydrophobia in which the powerful drug pilicarpina had been used without effect. The professor writes:—"The prodigious effects of this potent remedy soon showed themselves—profuse sweats and enormous salivation; and yet the malady continued its fatal course as usual. I was one of those who had hoped in the good effects of pilicarpina in cases of hydrophobia, and now this hope has vanished, and it is necessary that the fact should be known."

Mountaineering as Exercise.—Mountaineering is doubtless excellent exercise for the nervously strong and muscular, but it is unfortunate that it should be the pastime of the very class of persons least well fitted for its pursuit. Those who lead habitually intellectual, and, to a large extent sedentary lives, incur great peril of injury and accident when they resort to this arduous and altogether exceptional form of exercise in their annual holiday. They may be steady of nerve and clear-headed, strong of wind and limb; but the strain is too severe, and the overtaxed faculties of sense and power may at any moment give way suddenly, when life will be jeopardised or sacrificed. Members of our own profession need a word of caution in respect to the way they spend their hardly-earned vacation. We do not think that, as a class, they are particularly addicted to the climbing of mountains, but there are some who forget that unaccustomed labour of any kind, although it may be performed impulsively and perhaps with seeming ease—because there is for the moment some reserve of force on hand—is not safe work. A breakdown must reasonably be expected, and it is not prudent to venture life or limb on the hazard. Mountaineering, like everything else, requires long and continuous practice to make it an exercise which can reasonably be reckoned as salutary and within the bounds of a sound discretion. It is too laborious, too exacting to the sense-organs, and too severely exhausting to all the powers of life and energy, to be undertaken without more than a mere feeling of courage and power, which may be misleading. The mountaineer should be always in training, or he should only attempt such climbing as calls for no particular expenditure of nerve or muscle force, and involves no extraordinary risk.—*The Lancet.*

Letters to the Editor.

[The Editor does not hold himself responsible for the opinions of his correspondents. He cannot undertake to return manuscripts or to correspond with their writers. All communications should be as short as possible, consistently with full and clear statements of the writer's meaning.]

All Editorial communications should be addressed to the Editor of Knowledge: *all Business communications to the Publishers, at the Office, 74, Great Queen-street, W.C.*

All Remittances, Cheques, and Post-Office Orders should be made payable to Messrs. Wyman & Sons.

*** *All letters to the Editor will be Numbered. For convenience of reference, correspondents, when referring to any letter, will oblige by mentioning its number and the page on which it appears.*

"In knowledge, that man only is to be contemned and despised who is not in a state of transition. . . . . Nor is there anything more adverse to accuracy than fixity of opinion."—*Faraday.*

"Show me a man who makes no mistakes, and I will show you a man who has done nothing."—*Liebig.*

MR. MATTHEW ARNOLD ON KNOWLEDGE.

[520]—I learn by your extract from the *Nineteenth Century*, on p. 193, that Mr. Matthew Arnold is still hammering away at his chronic craze, concerning the supernal importance of the study of ancient classical literature. It may appear presumptuous on my part to differ with the apostle of sweetness and light—nay, I am thoroughly sure that it *will* appear presumptuous to Mr. Arnold himself, affording as he does so admirable an illustration of the appositeness of the celebrated definition that "toleration is letting you believe as I believe, intoleration wishing me to believe as you believe." As one, however, who, perforce devoted some years of his life to classical study, and who has spent no inconsiderable part of the remainder of it in the acquisition of knowledge of the natural and physical sciences, I at least claim to speak with a certain amount of experience, experience which, in the case of scientific study, I venture to think Mr. Arnold is scarcely in a position to share. Now, if the end of life be to cultivate the æsthetic faculty in man, there exists, I venture to affirm, even in modern (to say nothing of mediæval) literature, the most ample materials for this purpose; accessible, moreover, to thousands to whom the pious Æneas represents nothing, and to whom the childish and indecent legends of the inhabitants of Olympus are (happily) a sealed book. The classics, in real truth, merely supply a system of mental gymnastics; suited well enough to a certain intellectual type, but failing conspicuously when applied to another. I really wonder how much there is in our extant classical literature which is read for its own sake?—by which I mean for the sake of the information or instruction conveyed by it. It suits the purpose of Mr. Arnold to covertly sneer at and depreciate the value of the statement of such a fact as that "when a taper burns the wax is converted into carbonic acid and water;" but I confess that I find more that ministers to "the sense which we have in us for beauty" in Faraday's "Chemical History of a Candle," than I do in many parts of the works of Aristophanes: while I assuredly derive much more vivid impressions of what is most distinctively bestial in the human race from the perusal of Juvenal's Sixth Satire than I do from learning, through the imperishable researches of Darwin, that the ancestor of man was probably "a hairy quadruped, furnished with a tail and pointed ears, probably arboreal in his habits." I should be more urgent in insisting on the essential unsoundness of Mr. Matthew Arnold's advice "to choose to be educated in humane letters rather than in the natural sciences," were I not convinced that, in the present enlightened condition of public opinion, he has but small chance of being listened to. That the study of the Cosmos is destitute of those elements which minister to man's æsthetic faculties, or exercises a less refining influence on the human mind than the perusal of nasty fables, no one but a very fanatical enthusiast would, I think, now venture to assert. I confess that investigations into the physical structure of our visible Stellar Universe has exercised an indefinitely more elevating and purifying influence upon my own mind than even the perusal of the story of Leda and the Swan did.

A Fellow of the Royal Astronomical Society.

FAIRY RINGS.

[521]—It may be objected to the new phase of Mr. Williams's "hypothesis" that the Fairy Rings I referred to often occur on precipitously steep hill sides, where tethered animals are never found. Similar rings are often an intolerable nuisance on the well-kept lawns of mansions, opposite the drawing-room windows, in positions where hay-cocks and tethered animals are (not to put too fine a point upon it) extremely rare.

A Fairy Ring starts from a single fungus, or a small group of fungi; this little group exhausts the ground, and renders it unfit for the further growth of fungi. From this starting-point the underground spawn radiates, and in the second year the Fairy Ring appears; it is then about 6 in. or 9 in. in diameter. The fungi decay, and this decayed material suits the growth of grass; this luxurious grass (manured by the previous year's fungi) is usually termed the Fairy Ring. The third year the ring will be a foot or more in diameter, and so on to a hundred feet or more, the spawn always increasing from the centre outwards. Haycocks are never six inches or a hundred feet in diameter. If a small hole is dug just outside a Fairy Ring, the spawn of the fungi is invariably met with. When there is too much or too little rain, the fungi cannot come up, and this accounts for the curious absence of the Fairy Ring fungi in some seasons; the circle of spawn is, however, alive in the ground, and if the next year is suitable, the ring of fungi again appears, always just outside the luxuriant grass. In some places where Fairy Rings are common, two or more circles of underground spawn come in contact; at the point of contact the rings cannot go on, so semicircles or ogee-curves are the result. Tethered animals do not walk about in circles a foot in diameter, in semicircles, or ogee-curves.

Mr. Williams has confused several things together—the rank grass found about haycocks, manure-born fungi, and Fairy Rings. They are all quite distinct from each other. W. G. Smith.

MECHANICAL PARADOX.

[522]—Thanking you for replying to my last query, may I trouble you with the following?

In a book entitled "Remarkable Men" (published by The Society for Promoting Christian Knowledge) I find the following called "Ferguson's Mechanical Paradox," in which he (Ferguson) says: "Suppose you make one wheel as thick as other three, and cut teeth in them all, and then put the three thin wheels all loose upon one axis, and set the thick wheel to them so that its teeth lock into those of the three thin ones; now turn the thick wheel round, how must it turn the others?

"Turn the thick wheel which way you will, it shall turn one of the thin wheels *the same way*, the other *the contrary way*, and the third *no way at all*."

In the book above-mentioned, this mechanical paradox is fully illustrated, but not explained, and I have failed as yet to get an explanation of it. Cupidus Cognoscere.

ARE TOADS POISONOUS?

[523]—I have domesticated toads, frogs, lizards, slow-worms, snakes, and other reptiles, and have studied their habits. Some of my observations do not accord with the statements in the biological text-books, but on the question raised by Mr. Herbert Brown (No. 499) they are quite in harmony with the usual descriptions of the acrid secretions emitted from the pustules or warts on the skin of toads. I have seen several cases of dogs attacking toads, and in all the dog has suffered considerably in the manner described by Mr. Brown. On one occasion I dropped a toad much in the same manner as dogs do. His skin came in contact with an excoriation on my hand, and the result was like picking up something very hot indeed. They are quite innocent of any "sting" or poison-teeth.

W. Mattieu Williams.

SINGULAR COINCIDENCE.

[524]—A curious circumstance which happened to me in Switzerland in the year 1877 may perhaps be deserving of record. On August 4 I left my quarters at the Hotel Rigi Scheideck, where I had occupied No. 123, for the Hotel National, at Lucerne. Here I was struck by the fact that my room had the same number; but my surprise was greatly increased when on proceeding on August 6 to the hotel at Giessbach, I found myself again confronted by 123 on my door. The sequence, too, of the numbers was curious, and it so happened that the party consisted of three, though one of these occupied a separate room. T. W. Webb.

AN AUGUST METEOR.

[525]—On the evening of the 10th inst., about 1.45, whilst in the act of viewing with admiration and delight the great cluster in Perseus, my attention was called to a magnificent meteor which burst into view in Perseus, about 3° south of the point I was engaged upon. It shot slowly across in the direction of Ursa Major, leaving a beautiful stream of light in its wake, and burst about half-way to that constellation. I fixed my glass (a 3 in., with a power of 80) on it, and perceived a long waving light of a greenish hue, slowly fading away. Against the dark background it seemed like an immense crack in the sky, and had a most remarkable appearance. It was clearly visible for 45 seconds.

Yours truly,

Dukinfield, *Aug.* 11, 1882. William H. Shirley.

TARNISHED DAGUERREOTYPES.

[526]—I have a tinted daguerreotype which is much tarnished, so that the figure can only be seen in a particular light, and then imperfectly, while the surroundings are bluish-green. I should feel much obliged if I could be informed how or where it can be restored. I am a subscriber to Knowledge, and read in an early number that it can be restored. I was referred to my chemist, who, brought up with photographers, never heard of restoring a tarnished daguerreotype. F.

DRAMA FOR AMATEURS.

[527]—Wanted, the names of two or three dramas subject to the following conditions:—(1.) Sufficiently elevated and improving in tone for representation by a Mutual Improvement Society at one of their meetings. (2.) One that we could curtail, if necessary. (3.) Containing a cast—say three ladies and three or more gentlemen. We should have three months for preparation, and possess a fair amount of amateur talent. Hon. Sec.

THOUGHT READING.

[528]—You may be interested to know that I have been successful in a feat of thought reading somewhat similar to, though less wonderful than, that performed by Cassneuve, described by your correspondent "Henry Milton." It was this:—

I wrote on a slip of paper the name of, say, a flower and an animal, folded it up, and gave it to a friend, requesting him to look me steadily in the face and mention the name of the first flower that came into his head. Having done this, I asked him to mention the name of the first animal that occurred to him. In both cases the answer was correct. I have tried the experiment several times since, and have been, generally speaking, successful; on the second guess, almost invariably so. The *modus operandi* was simply that my friend should look me straight in the face and mention the first which occurred to him of the kind I had told him to think of. I, on my part, simply concentrated my thoughts on the object to be guessed. James Deas.

BALL-BEARINGS TO BICYCLES.

[529]—In reply to your correspondent, Thos. B. Walker, I think he has fairly made out his case, but it will probably interest him to know that in many of the best makes of tricycles the manufacturers have reversed the method adopted in the construction of bicycles, and have put ball-bearings to the small steering-wheel, while using plain bearings to the large wheels. This is the case with the Burdess Sterling Tricycle, which I am at present testing, and of which I think favourably. There is great originality in the construction of this machine; the cranks are driven backwards to drive the machine forwards; this gives the rider great power, and steadies the machine in quick running and going down hill.

Your correspondent's well-reasoned remarks will, I have little doubt, be useful in directing the attention of manufacturers to the desirability of putting ball-bearings to the small or trailing wheels of bicycles. For my own part, if I were compelled to have a bicycle with only one set of ball-bearings I should prefer those bearings being applied to the hind wheel, because I have found that they generally run well where they have to run with a great velocity and under small weight, but more frequently get out of order when they have to bear any amount of weight while running, and when they do get out of order they are very difficult to set right without tools and appliances, which amateurs seldom possess.

John Browning.

XUM

Answers to Correspondents.

*** *All communications for the Editor requiring early attention should reach the Office on or before the Saturday preceding the current issue of* KNOWLEDGE, *the increasing circulation of which compels us to go to press early in the week.*

HINTS TO CORRESPONDENTS.—1. *No questions asking for scientific information can be answered through the post.* 2 *Letters sent to the Editor for correspondents cannot be forwarded, nor can the names or addresses of correspondents be given in answer to private inquiries.* 3. *Correspondents should write on one side only of the paper, and put drawings on a separate leaf.* 4. *Each letter should have a title, and in replying to a letter, reference should be made to its number, the page on which it appears, and its title.*

JOHN GREENFIELD. If the sun's rays have been all these millions on millions of years working their way round, and even now give no trace of coming back, I fear I must ask you to wait till they do begin to come back before discussing your theory. Science finds what looks like ample reason for being certain that the solar rays, or rather light-undulations, travel in constantly enlarging spheres around the sun as centre. There is absolutely nothing known in physics to suggest that this action can ever reverse its course. There was no occasion to correct the spelling, the printers would have done that if your letter had been marked for insertion; but it could not be, except for Paradox Corner.—NAMUK. 1. Draw through middle point, *c*, of AC, a perpendicular, cOD, which will also be a diameter to the circle, O being the centre. From O take on OD a length, OE, equal to Ac. Then EB, perp. to OD will meet the circle in the required point D. 2. The highest point of a primary is never so high as 45 degrees above the horizon. It is highest when the sun is on the horizon, and it is then about 41 degrees high. The higher the sun the lower the rainbow, and the fewer the degrees in its arc.—AMATEUR desires to know the name, price, and publisher of best book giving chemical tests for various substances.—L. J. P. Rodwell's Scientific Dictionary, price, I think, 10s. 6d., gives modern scientific terms —J. H. GRANT. Your description of Watt's parallel motion suggests that you are considering a simpler form than the one I am familiar with. Will you kindly send a sketch showing where C, C′, &c., of your de cription are situated? You must not expect to find any way of determining a so that the equation you have obtained shall be as nearly as possible an equation of the first degree; all you can do is to obtain an expression for the deviation from the straight when this is a maximum (that is, where x is greatest or least) and then differentiating with respect to a determine for what value. Of a this maximum deviation is least.—W. A. E. wants to know whether alcohol in yeast, when made into bread, is destroyed in the baking? also if alcohol is to be obtained from bread baked brown by the addition of pure water; and if so, whether excluding the air would be a preventive.—H. B. LINDSAY. 1. The *Edinburgh Review* is decidedly wrong. Our English system of numeration reckons a billion as (a million)^2, a trillion as (a million)^3 and so on—a very sensible and uniform method. Americans use the unwise (and practically absurd) plan of calling a thousand millions a billion, a thousand billions a trillion, and so on. It would puzzle their arithmeticians to explain how the bi-, tri-, and quadri-, &c., of these numbers are to be interpreted. 2. It is commonly supposed a French league is three English miles; but there are, in fact, two French leagues neither of which is quite three miles in length, one of 2,000 *toises*, or 2·42 English statute miles, which was formerly the legal posting measure, the other the 25th part of a degree, or about 2·77 English miles. The former is evidently intended by Flammarion in the passage you refer to. The English league is the 20th part of a degree, or three nautical or geographical miles.—F. CRAWSHAW. Letter forwarded to publishers. English astronomers regard the day as beginning at noon at Greenwich Aug. 3, 1 o'clock p.m., being Aug. 3, 1 h.; but Aug. 4 1 o'clock a.m., being Aug. 3, 13 h. But referring to civil, of course there must always be a question at any place nearly 180 degrees from us, how the ordinary day that is passing should be called—whether, for instance, at or near Aug. 3, 0h., astronomical time, or noon of Aug. 3, civil or mean solar time at Greenwich the day which is near its commencement shall be called August 3 or 4. If we pass eastward from Greenwich (the earth being supposed to cease rotating for the moment) we find the hour earlier and earlier in the morning till, when we arrive at 180° east, it is midnight, and the morning hours of Aug. 3 are just about to begin. If we go westward, we find the time later and later in the afternoon till, when we arrive at 180° west, which is the same place we reached the other way, it is midnight, and the morning hours of Aug. 4 are just about to begin. But for other longitudes we meet with the same difficulty. All we can say of the day at any place is that it overlaps the Greenwich day of the same name by such and such a portion. Even at Paris, for example, there are 9¼ minutes, when the day differs from the Greenwich day. Thus, from 11.50¾ in the evening of Aug. 3 at Greenwich till midnight closing Aug. 3 at Greenwich, it is the beginning of Aug. 4 at Paris.—W. MEADOWCRAFT. When you have said that the apple is in the smaller box, and the smaller box in the larger, what more is there to say? —J. A. OLLARD. That seems about it. Besides, there is a certain degree of probability that what the mind regards as probable will really occur.—J. THOMSON. Do not know of Ling's book. No instrument has yet been invented for measuring brain movements. As trepanning would seem a necessary preliminary, I venture to predict that such an instrument, when invented, will not be widely popular.—A. McD. 1. Dr. Ball refers to appearances in the transit instruments, which inverts. 2. No: R.A. of a star is not the time when the star crosses the meridian of a place; but the interval in time between the passages of the meridian by (i.) the first point of Aries and (ii.) the star. 3. You are right in your correction of what Dr. Ball says as to zenith dist + colat. being equal to polar distance; it should be colat. ± zenith distance, according as star crosses meridian south or north of the zenith.—A. STRADLING. Most willingly; not undertaking, of course, to insert everything.—T. CHASE COX. Darwin attributes the colours of human races to the gradual influence of sexual selection. Slight differences at first between different races were gradually increased. When the change was in progress, there must have been, what is now not seen, a marked difference of colour between the two sexes. As to the lady and gentleman you mention, science may express an opinion when it has had evidence of their having existed.—E. SCOTT. Darwin touches, in his "Descent of Man," on the origin of the emotions, feelings, conscience, &c. It is not very wonderful that we have but very vague evidence on this point. You ask whether evolution recognises the human soul, and, if nothing can be destroyed, what becomes of it after the death of the body? I am not concerned to say what evolutionists believe about the soul, a future life, and so forth. These matters lie outside *our* field of inquiry; but as to your question, regarded scientifically, might it not be paralleled thus,—Science recognises the human mind; nothing can be destroyed; what becomes of it after death? *or thus*, Science recognises human strength; nothing can be destroyed; what becomes of our strength after death? Science can only recognise the strength, the mind and its powers, the soul and its emotions, as functions of the body.—ESCRIMADOR. You must have been misinformed by the person who stated that a book giving the Latin roots (pure radicals) issued by the Clarendon Press, was suppressed lest the pupils should outlearn the teachers! —C. A. WILLIAMSON. The information was given in KNOWLEDGE for August 4, p. 170. Publishers, Messrs. Trübner & Co., price 15s. —J. RAWCLIFFE. Fear cannot find space for critique on Mr. Whewell's article in *Journal of Science*, October, 1880, on "Free Forces in Nature."—J. BEDFORD. You are known. —FACIEBAT. Before November we shall have some papers on meteors and shooting stars. Dropped K. because many misunderstood.—F. J. M. Fear must ask some reader with more leisure than we have to determine on what day the full moon fell in July, 1573.—W. W. FAWCETT. In what way do Dr. Hermann's assertions affect what I said? Have I ever asserted there were no cruel and wrong-headed vivisectionists?—Z. Y. X. Many thanks. We have sent on the electric boy to our electrical contributor for his opinion.—J. WILSON. We do not see the difficulty. It is certain that ever since sub-aerial denudation has been in progress, every formation must have been partially consumed to provide materials for the next; portions also would remain much as they were originally formed. Why should you go on to reason as if geologists asserted that the whole of each formation was consumed while the next was forming? In so doing you make the difficulty which troubles you.—H. MARRIOTT. On the hottest day you will often see *cirrus clouds*, which consist of ice crystals. Whatever theory we accept as to the formation of hailstones, we know that they are formed where the air is at a temperature below the freezing-point.—J. RALPH. You have taken Mr. Mattieu Williams somewhat too seriously; of course he does not really mean that drinking habits should be encouraged in order to get rid of the worse members of society. Besides, he speaks only of the coarser type of drunkards. We insert, however, as much of your letter as we can find space for.—A. H. SKELTON. I noticed the two misprints at p. 170, 1880 for 1800. There was only one wrong in proof, and I corrected that, but somehow with the result that both were made wrong. It did, not, however, make the answer unintelligible; for I received a note from the querist thanking me for the reply, which he had manifestly read as corrected. So, as the answer had only been intended for him, I did not think it worth while to correct the mistake. There was a very annoying erratum in No. 41, first page. I had written that some regard "the results of sound reasoning as if they were fanciful hypothesis." For "hypothesis," I found "hypotheses," which I corrected. To my horror I found the sentence altered into the ungrammatical and unmeaning form

in which it actually appeared, the results of sound reasoning being regarded as if *it* were *a* fanciful hypothesis. Hypothesis in the abstract, as distinguished from any particular hypothesis or hypotheses, was, of course, what I intended.—S. W. Flannel next to skin as best for bodily health,—therefore better for the mind,—*mens sana*, &c. For the other trouble there is nothing but resolute will; which of us has not been troubled that way? Still, busy work which has also interest for the mind will in the long run chase from us thoughts we have no wish to entertain.—J. E. Okill. Pardon me, it is *you* who have "missed the mark again:" preferring beer to water is not the same as craving strong drink. As the old song has it, when I am hot and tired

I loves a glass of good beer,
I'm partikler partial to beer.

Yet I assuredly have no craving for it, and for ten years have scarce tasted it. You think few, but, so far as I can judge, every reader of Knowledge reads these Answers.—John Rouse. Although the discoveries of asteroids have been rather common of late years, the subject is full of interest. I am planning a paper in which the ingenious ideas of my friend, Professor Kirkwood, of Bloomington, Indiana, will be considered. I look upon his discovery respecting the arrangement of asteroidal distances as full of interest.—J. V. E. There are so many articles waiting that I fear it would be unwise to invite you to send yours. It would, however, be returned. Not undertaking to return, &c., is not the same as undertaking not to return.—E. A. Francis. I venture to mention my "Half Hours with the Stars," published by D. Bogue, price 2s. 6d., as likely to help you. I have no pecuniary interest (never had in fact) in the sale of the book, or would scarcely mention it. Still, I think it would be of use to you.—M. M. W. We share your views; but the subject is outside the line we marked in our first number. It is better avoided.

ELECTRICAL.

James Nelson Fraser. You need not be afraid of asking questions, simple though they be, more particularly if they are such as it is difficult to find a direct answer to in the ordinary elementary text-book. Where specially made zinc is unobtainable, amalgamation should always be resorted to. It is a simple process, which you can carry out for a few pence. Get a little sulphuric acid (a pennyworth of oil of vitriol from the oil-shop will do) and mix with water, in the proportion of one of acid to about twelve or more of water. Place your zinc in this (to remove surface impurities), and leave it until it nearly stops fizzing. Then with the aid of a piece of wool, &c., the zinc being still wet, rub in a little mercury until you get a uniformly bright surface. If it isn't bright all over dip it in the water again, and then give it another rub. Don't be wasteful with the mercury. A globule about the size of a pea is amply sufficient for a good-sized plate.—S. Crosse. The half of the ring nearest the magnet assumes a polarity opposite to that of the inducing pole, while the remote half assumes the like polarity. The neutral line in this case is the diameter of the ring at right angles with the axis of the magnet. No change is produced by coil copper wire round the stationary iron ring.

Our Whist Column.

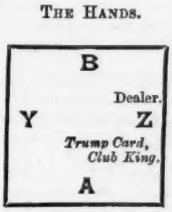
By "Five of Clubs."

THE following game illustrates well the advantage of understanding partner's play, or of being assured that partner plays according to some definite plan in particular cases. The hand resembles one described by Drayton, and so closely, that it may be regarded as the same hand. (It was written from memory of that hand.)

The Hands.

A.
Clubs—Q, Kn, 9, 4.
Hearts—10, 7, 6.
Spades—9, 8, 2.
Diamonds—Q, 6, 2.

Y.
Clubs—10, 5.
Hearts—9, 5, 4, 2.
Spades—A, K, 4.
Diamonds—K, 10, 7, 4.



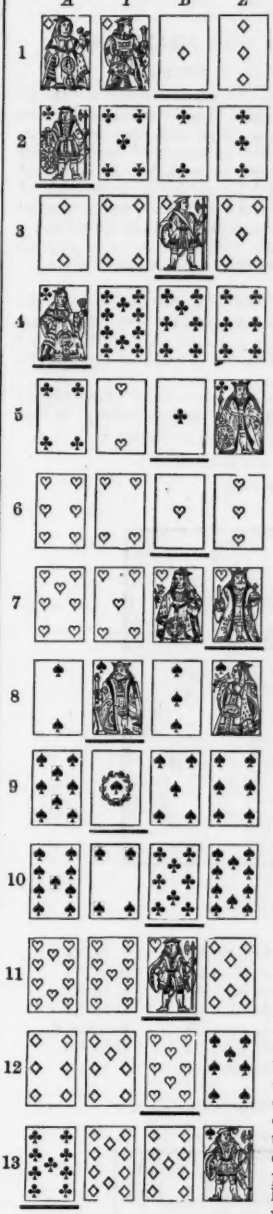
B.
Clubs—A, 8, 7, 2.
Hearts—A, Q, Kn, 8.
Spades—5, 3.
Diamonds—A, Kn, 9.

Z.
Clubs—K, 6, 3.
Hearts—K, 3.
Spades—Q, Kn, 10, 7, 6.
Diamonds—8, 5, 3.

Score:— *A*, *B*, = 0; *Y*, *Z*, = 0

THE PLAY.

Note.—The card underlined wins the trick, and card below leads next round.



REMARKS, INFERENCES, &c.

1. *A* having only three-card suits, outside trumps, and not sufficient strength to justify a trump lead, leads the best card from a short suit. *B* holding the Knave knows that the lead is not from Q, Knave, ten, or from strength. He infers, therefore, that *A*, who is a steady player, has four trumps, but is not strong enough to lead trumps. He, therefore, having four trumps, leads one, through *Z*'s King.

2. *A* cannot as yet tell whether *B* has led from strength in trumps, or, recognising evidence of length in trumps in *A*'s hand, has simply led through the honour to help him. He therefore does not return a trump.

3 and 4. *B* again plays through the honour; and now *A*, seeing his partner must have four at least,

5. Returns a trump, which draws the King.

The rest of the hand plays itself. At 8 and 9, *Y* plays to clear his partner's suit, but the third round in spades is ruffed.

We cannot say we altogether approve *A*'s play. Having no means of knowing whether diamonds were his partner's suit or one of his opponent's, he should not, we think, have thrown away the Queen; had the suit been headed by the Knave, he could not have done better than to lead the best.

EASY END GAME (Page 174).

If *Z* wins the trick with his small trump, *Y Z* lose. Winning with his Queen of trumps, *Z* leads the three. *Y* having the tenace over *A* wins two rounds of trumps, and leads his winning heart.

Correct solutions received from J. Hargreave, R. M. Grierson, F. Y. L., Two of Hearts, Geo. H. Bonner, Caudle, Green Baize, Sandy Man, and R. T. Prout.

Playing with a Bad Partner.—In the face of the immense variety of the style of play one may meet with, the only general advice one can give is, as soon as it becomes apparent that your partner does not understand your own system, observe his play carefully, and endeavour to discover what his peculiarities are; and if you find he has any fixed habits at all, you may in most cases adapt your play to them, and so turn them to your joint advantage. If he cannot, or will not, fall in with your system, you must adopt his, and so endeavour still, in defiance of him, to make some sort of a combination, and avoid the cross purposes which are so beneficial to the adversary.

Pole.

A couple of notoriety-seekers were married in a balloon at Topeka, Kansas, recently, and afterwards took a little bridal trip into cloudland.

A man in Rome, Ga., who has been experimenting in extracting sugar from water-melons, finds that they contain seven per cent. of saccharine matter, or pure sugar, and estimates that an acre of good land would produce 34,500 pounds of melons, from which 2,415 pounds of sugar could be extracted, worth, at 10 cents, $241.50.

Our Chess Column.

By Mephisto.

MENTAL PHOTOGRAPHY FOR AMATEURS.

A Game by R. G. and H. C. Brothers.

WE think the above designation the most appropriate one to apply to blindfold play. A game is not carried on without sight of the board by means of memory pure and simple—that is, the recollection of all moves made—but by means of devoting the mind to the recollection of the position as a whole. In blindfold play, the player is constantly engaged in taking a photograph of the position, but without the help of the optic nerve, which usually transmits a reflection of the board to the brain. It is, therefore, a mental reflection, or photograph, which enables a player to play his moves, and make his combinations, without sight of the board—*i.e.*, blindfolded.

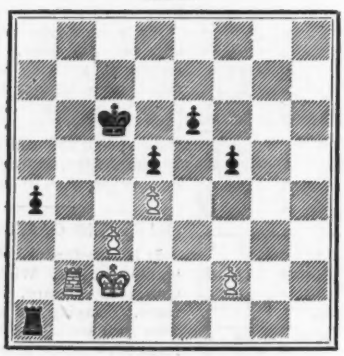
Amateurs who wish to practice blindfold play, must bear the above facts in mind in their practice. A great help in that direction may be obtained by putting up on a board easy positions, and after looking at them steadily for a time, try to recollect the position without sight of the board.

Messrs. H. C. and R. G. Brothers have sent us a game played together blindfolded, which extended to fifty-seven moves. It was well contested throughout. We give the end position :—

Position after Black's 43rd Move.

R. G. Brothers.

Black.



White.

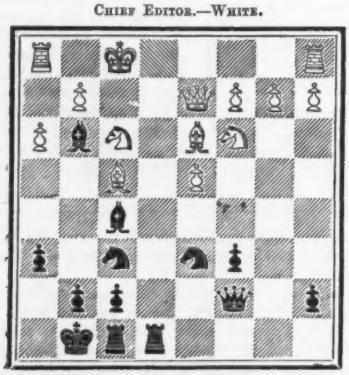
H. C. Brothers.

The game was continued with :—

44.	R to Kt8	R to R7(ch)	51.	R to R7(ch)	K to B3
45.	K to Kt sq	R takes P	52.	R to R3	K to B4
46.	R to QR8	P to B5	53.	K to Bsq	K to K5
47.	R takes P	P to B6	54.	K to Qsq	R to K7
48.	R to R6(ch)	K to Q2	55.	P to B4	P takes P
49.	R to R7(ch)	K to Ksq	56.	R to B3	R to K6
50.	R to R6	K to B2	57.	Resigns.	

Position after White's 20th Move.

Chief Editor.—White.



Chess Editor.—Black.

In reference to the above position, and our note (7) of the game, published last week, a correspondent writes that White need not have taken the B on his 22nd move, *i.e.*, 20. B takes B(ch), 21. P takes B / Kt to R4, but played 22. B takes RP (see note *d* of Chief Editor's notes). If, then, P takes B, 23. Q takes P, and it looks as though White gets back the piece. If 22. Kt to KB4 23. Q to Kt5 / Kt takes B 24. Q takes Kt.

The proposed move would not have been good. The following would have resulted :—

20. B tks B(ch) 21. P takes B / Kt to R4 22. B takes RP / Kt to KB4 23. QtoKt5(or *a*) / B to B5

and White will lose his Queen, whether he takes either Knight or plays Q to Kt4.

(*a*) If 23. B to Kt5, Black wins by 23. P to B3.

A correspondent sends us the score of a game played, and asks for our opinion on the following point. In defending a salvio, his opponent played K to K2. Which is the best way of meeting the novelty ?

The position is brought about as follows :—

1.	P to K4 / P to K4	2.	P to KB4 / P takes P	3.	Kt to KB3 / P to KKt4
4.	B to B4 / P to Kt5	5.	Kt to K5 / Q to R5(ch)	6.	K to K2

This move, which is after the fashion of the move introduced by Steinitz in the Vienna game, is obviously bad. The King is safer placed on KBsq, than on K2, because there he is exposed to direct attack, from which he will have to retire either on to Bsq (where he ought to have moved at once), or to Q2, with a very inferior game. A likely continuation would be—

6. Kt to KR3 7. P to KR3(best) / P to B6(ch) 8. P takes P / P takes P(ch) 9. K to Q3

with an unenviable position.

SOLUTIONS.

End position, No. 46, p. 139.—The mate is effected in six moves, instead of five, as stated by mistake.

Problem No. 48, by H. A. N., p. 155.

1. K to B4	1. P to Q4(ch)
2. K to Q4	2. KtP moves
3. K takes P (mate).	

No. 49, by Leonard P. Rees, p. 173.

1. Q to KRsq	1. anything
2. mates accordingly.	

GAMES BY CORRESPONDENCE.

M. J. Hooton *v.* Edward Wilson.
J. B. Walker *v.* Henry Freeman.
Jael *v.* J. Carraway.

The first-named player has the move.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess-Editor.*

A. H. G.—Such a book has not yet been published.

John Simpson.—Problem received with thanks. Will be examined.

"H. F. L. Meyer's Guide" deals on problems.

Jael.—Game received. Will be examined.

Y. T. K., Z. Y. H., Tessir.—Problem No. 49 : If 1. Q takes RP, 1. P to QB4, and there is no mate on the move.

A. A. B.—Thanks for letter. Will be pleased to receive a good game.

Correct Solutions received of Problems No. 47.—E. W. Croskey.

No. 48.—Jael, J. B. B., I. P. Moleque, A. J. H., Henry Freeman, A. A. Dent, G. W., K. B. Kimpton, John Simpson, H. V. T.

No. 49.—C. W. Croskey, Henry Freeman, A. A. Dent, John Simpson, H. V. T., K. B. Kimpton, A. J. H., Jael, Herbert Jacobs, Charles Hartley, J. Carraway, Belmont, Moleque.

No. 50.—G. W., H. V. T., John Simpson, J. K. Milne, E. J. J., Berrow, Geo. H. Bonner, C. W. Croskey, A. J. H., J. B. B., Belmont, J. P. Clayton, A. W. Cooke, J. J. Dorrington. Belmont asks is life long enough for four movers ?

XUM